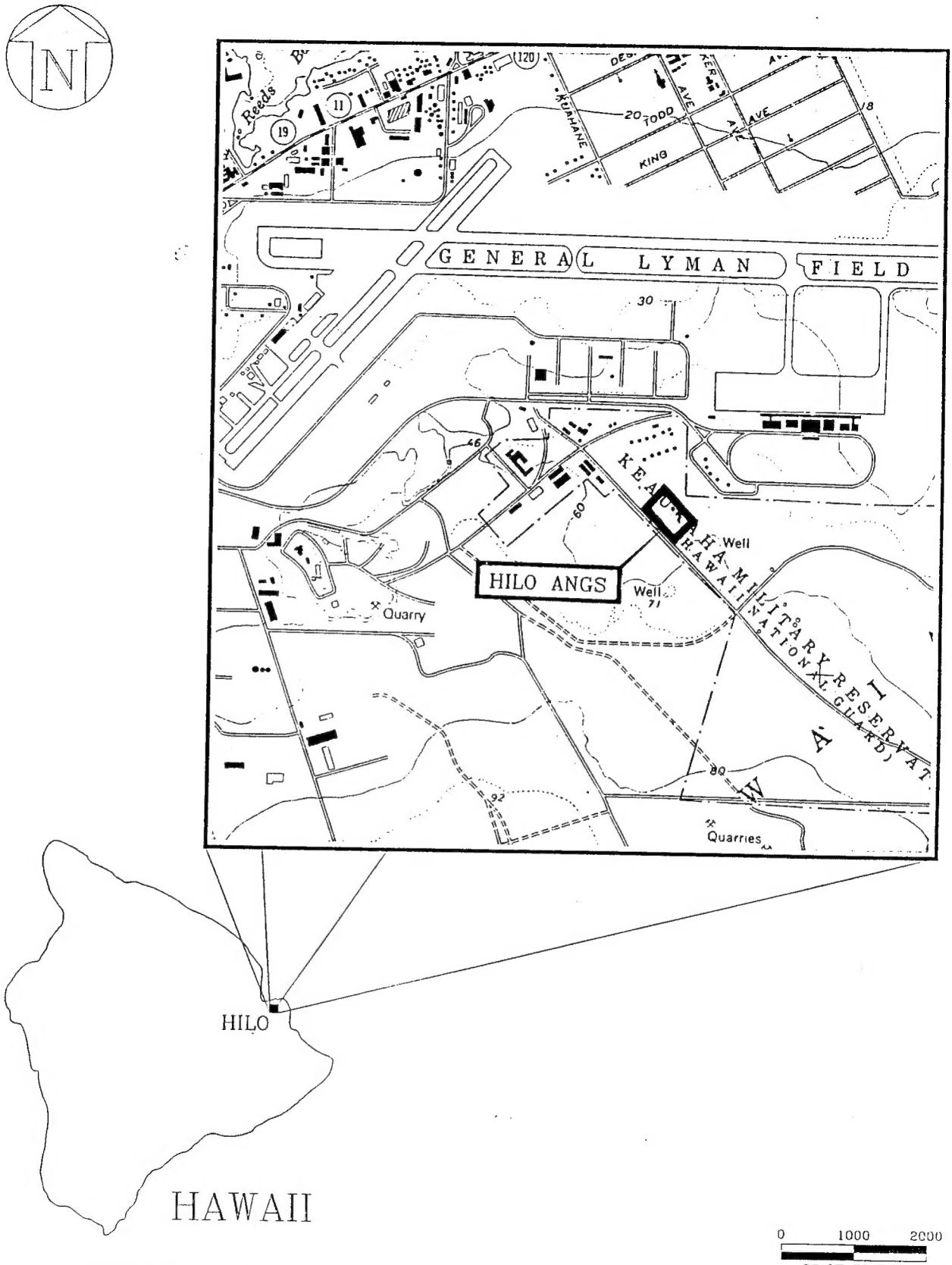
INSTALLATION RESTORATION PROGRAM (IRP) PRELIMINARY ASSESSMENT OF THE 291st COMBAT COMMUNICATIONS SQUADRON

291st COMBAT COMMUNICATIONS SQUADRON
HILO AIR NATIONAL GUARD STATION
HAWAII AIR NATIONAL GUARD
HILO, HAWAII

JANUARY 1995

AIR NATIONAL GUARD READINESS CENTER
ANDREWS AFB, MARYLAND



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SCALE IN FEET

SOURCE: USGS 7.5' TOPOGRAPHIC MAP, HILO, HAWAII 1981.

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R\HILO\SITE

INSTALLATION LOCATION MAP

291st Combat Communications Squadron

Hilo Air National Guard Station

Hilo, Hawaii

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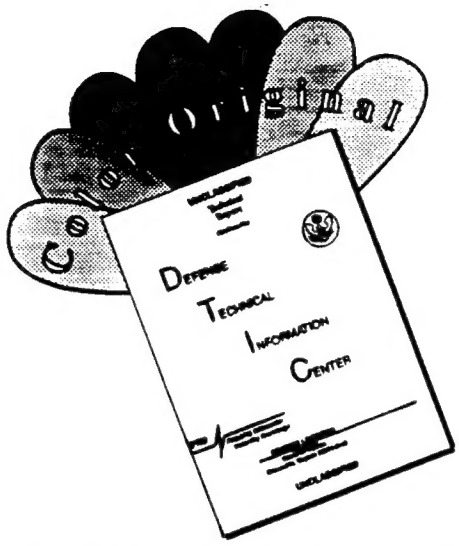

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The document identifies ANGRC attempt to assess possible Installation Restoration Program sites at the station. The process involves research via personal interviews, record searchs, review historic data, assessing "As Built Drawings", Aerial photographs, and a site visit.

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291st COMBAT COMMUNICATIONS SQUADRON
HILO AIR NATIONAL GUARD STATION
HAWAII AIR NATIONAL GUARD
HILO, HAWAII

JANUARY 1995

Prepared For

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291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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LIST OF ACRONYMS

AFB	Air Force Base
ANG	Air National Guard
ANGRC/CEVR	Air National Guard Readiness Center Installation Restoration Programs Branch
ANGS	Air National Guard Station
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
CBCS	Combat Communications Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERP	Defense Environmental Restoration Program
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DQO	Data Quality Objectives
EO	Executive Order
FFS	Focused Feasibility Study
FS	Feasibility Study
gpm	Gallons per minute
HIANG	Hawaii Air National Guard
HM/HW	Hazardous Materials/Hazardous Waste
IRP	Installation Restoration Program
KMR	Keaukaha Military Reservation
MOGAS	Motor gasoline
MSDS	Material Safety Data Sheet
MSL	Mean sea level
NPL	National Priorities List
OpTech	Operational Technologies Corporation
PA	Preliminary Assessment
PL	Public Law
ppm	Parts per million
RA	Risk Assessment
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
R&D	Research and Development
RI	Remedial Investigation
RM	Remedial Measure
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	Soil Conservation Service
SI	Site Investigation
USAF	United States Air Force
USC	United States Code

LIST OF ACRONYMS (Concluded)

USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UST	Underground Storage Tank
UTA	Unit Training Assembly

INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT

EXECUTIVE SUMMARY

A. Introduction

The Air National Guard Readiness Center (ANGRC), Installation Restoration Programs Branch (CEVR) has the responsibility for managing the Installation Restoration Program (IRP) on all property the Air National Guard (ANG) maintains. In April 1994, the Preliminary Assessment (PA) for the 291st Combat Communications Squadron (CBCS), Hilo Air National Guard Station (ANGS), Hilo, Hawaii County, Hawaii (also referred to as the Station) was initiated by personnel from the ANGRC/CEVR. Operational Technologies Corporation (OpTech) of San Antonio, Texas, was tasked by the ANGRC/CEVR to conduct the Preliminary Assessment at the Station. The PA included:

- An onsite visit, conducted by OpTech and ANGRC personnel on April 11 and 12, 1994, including interviews with both Station personnel and knowledgeable personnel at Hickam Air Force Base (AFB) and Fort Ruger;
- The acquisition and analysis of pertinent information and records on hazardous materials use and hazardous waste generation and disposal at the Station;
- The acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- An assessment of the Station to determine if areas of concern (AOCs) exist which may have been contaminated with hazardous materials/hazardous wastes (HM/HW).

B. Major Findings

Past activities at the Hilo ANGS involved the use and disposal of materials and wastes which could be categorized as hazardous. The major operations of the Station that use and dispose of HM/HW include motor vehicle maintenance, fuels management, corrosion control, power

production and the paint shop and battery shop. Wastes generated by these activities include waste oils, spent fuels, cleaning solvents, paint wastes, and thinners.

Interviews were conducted with 18 Station personnel and knowledgeable personnel at Hickam AFB and Fort Ruger. As a result of these interviews and a field survey, several areas were identified as having the potential for contamination as a result of past Station activities.

C. Conclusions

No areas of concern were identified at Hilo ANGS.

D. Recommendations

No further IRP investigation is warranted since no formal areas of concern have been identified.

SECTION 1.0 INTRODUCTION

1.1 BACKGROUND

This Preliminary Assessment (PA) covers the 291st Combat Communications Squadron (CBCS), Hawaii Air National Guard, Hilo Air National Guard Station (ANGS), Hilo, Hawaii. The Station was constructed in 1982, and some operations at the Station over the ensuing 12 years have involved the use and disposal of materials and wastes which could be categorized as hazardous. Consequently, the Air National Guard Readiness Center initiated the Installation Restoration Program (IRP) at the 291st CBCS. Coordination of the IRP at the Station is the responsibility of the 154th Group Environmental Management Office located at Hickam Air Force Base (AFB), Oahu, Hawaii.

1.2 INSTALLATION RESTORATION PROGRAM (IRP)

The IRP is a comprehensive program designed to:

- Identify and fully evaluate suspected problems associated with past hazardous waste disposal and/or spill locations on Department of Defense (DoD) installations; and

- Control hazards to human health, welfare, and the environment that may have resulted from these past practices.

During June 1980, the DoD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM 80-6) requiring the identification of past hazardous waste disposal sites on DoD installations. The policy was issued in response to the Resource Conservation and Recovery Act (RCRA) of 1976 and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law (PL) 96-510 of 1980, commonly known as "Superfund." In August 1981, the President delegated certain authority specified under CERCLA to the Secretary of Defense through an Executive Order (EO 12316). As a result of EO 12316, the DoD revised the IRP by issuing DEQPPM 81-5 on December 11, 1981, which reissued and amplified all previous environmental directives and memoranda.

Although the DoD IRP and the U.S. Environmental Protection Agency's (USEPA) Superfund Programs were essentially the same, differences in the definition of program activities and lines

of authority existed. These differences were rectified with the passage of the Superfund Amendments and Reauthorization Act (SARA, PL-99-499) of 1986. On January 23, 1987, a Presidential Executive Order (EO 12580) was issued which effectively revoked EO 12316 and implemented the changes promulgated by SARA.

The most important changes put into effect by the SARA legislation include:

- Section 120 of SARA provides that federal facilities, including those within the DoD, are subject to all provisions of CERCLA/SARA concerning site assessment, evaluation under the National Contingency Plan (40 CFR 300), listing on the National Priorities List (NPL), and removal/remedial actions. The DoD must therefore comply with regulations and criteria promulgated by USEPA under Superfund authority.

- Section 211 of SARA also provides continuing statutory authority for the DoD to conduct its IRP as part of the Defense Environmental Restoration Program (DERP). The statutory authority was emplaced by adding Chapter 160, Sections 2701 - 2707 to Title 10, United States Code (10 USC 160).

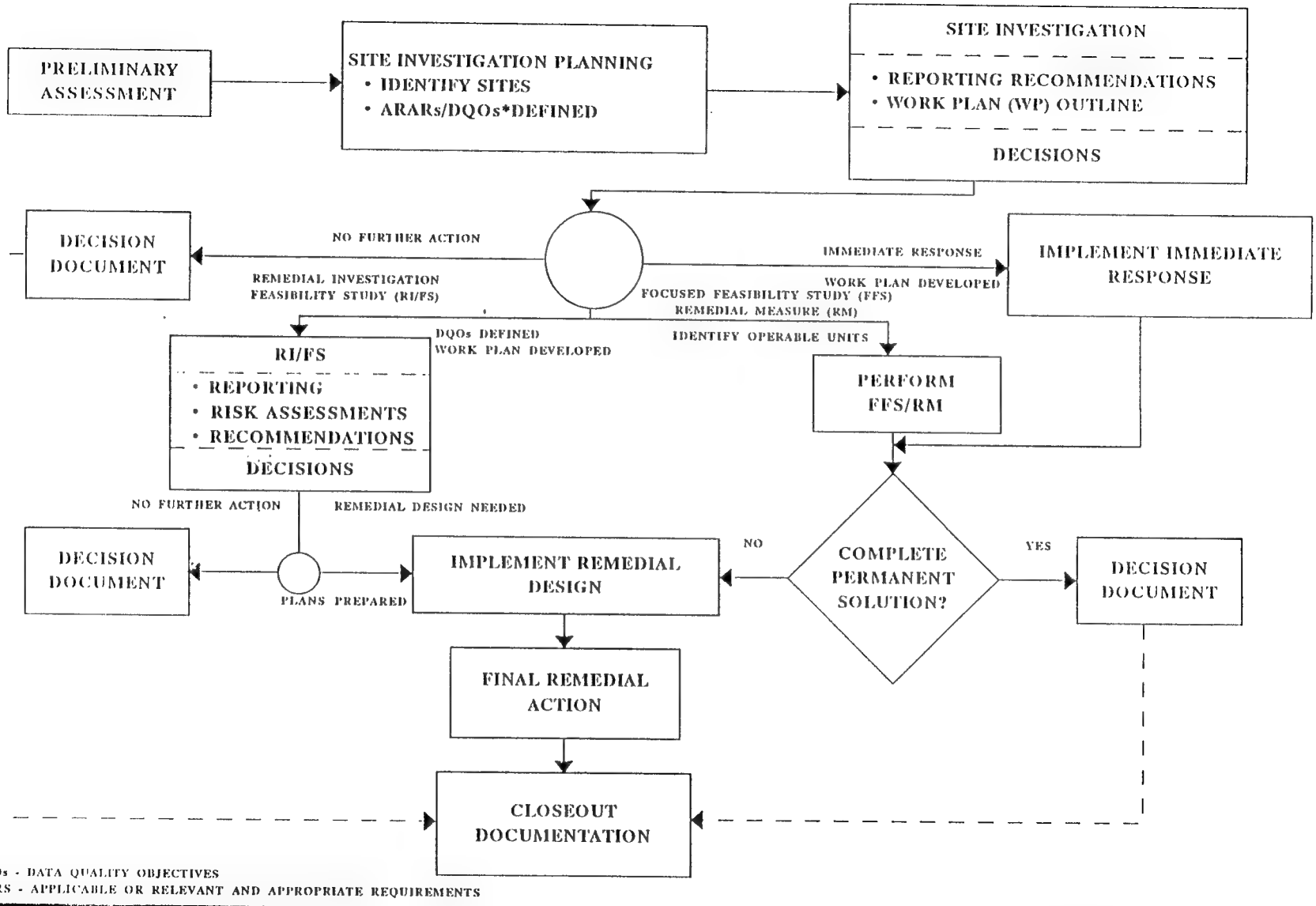
- SARA also stipulates that terminology used to describe or to otherwise identify actions carried out under the IRP shall be substantially the same as the terminology of the regulations and guidelines issued by the USEPA under their Superfund authority.

As a result of SARA, the operational activities of the IRP are currently defined and described in the following section and are illustrated in Figure 1.1.

1.3 PURPOSE

The purpose of this Preliminary Assessment under the IRP is to identify and evaluate suspected problems associated with past waste handling procedures, disposal sites, and spill sites on Hilo ANGS property.

The potential for migration of hazardous contaminants was evaluated by visiting the Station, reviewing existing environmental data, analyzing Station records concerning the use and disposal



* DQOs - DATA QUALITY OBJECTIVES
ARARS - APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

FIGURE 1.1

HILOXFLOWDIAG

FLOW OF INSTALLATION RESTORATION PROGRAM TASKS
291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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of hazardous materials and the generation of hazardous wastes, conducting interviews with current and past base personnel who have knowledge of historical waste handling and disposal techniques and practices, and screening available sources to obtain preliminary data concerning the suspected contamination. Additionally, available information within the public domain was gathered to obtain sufficient data to establish the environmental setting for Hilo ANGS.

1.4 SCOPE

The scope of the PA was limited to the identification of sites at and under the primary control of the Station and the evaluation of potential receptors. The PA included:

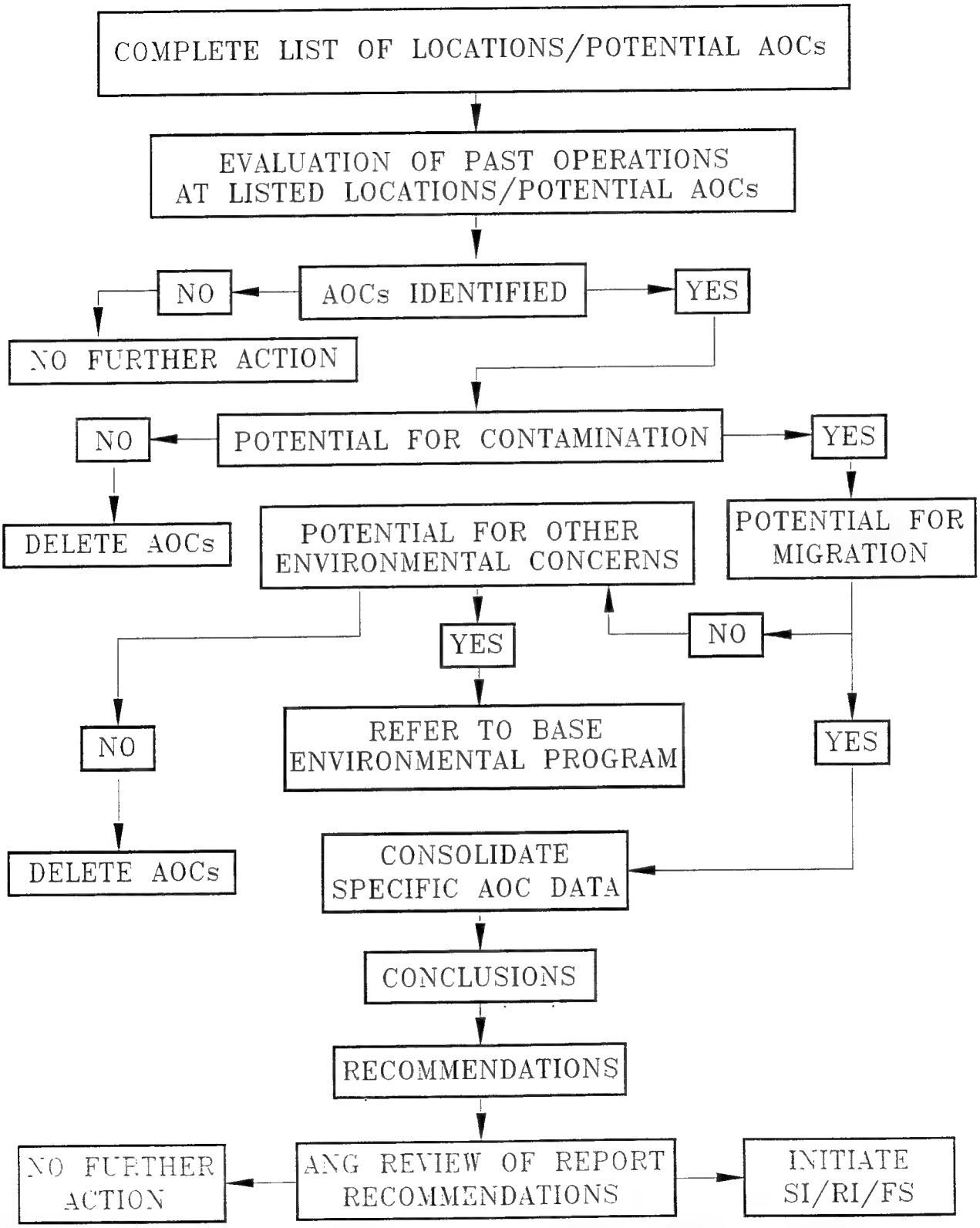
- Onsite visits on April 11 and April 12, 1994;
- Interviews with 18 current Station personnel and knowledgeable personnel at Hickam AFB and Fort Ruger.
- The acquisition of records and information on past and present hazardous materials use, waste handling practices, and waste disposal on Hilo ANGS; and
- The acquisition of available information such as geological, hydrological, meteorological, land use and zoning, critical habitat, and related data from Federal, State, and local agencies.

1.5 METHODOLOGY

The PA began with an inbriefing with key Hawaii Air National Guard leaders to explain the purpose of the PA and to solicit their support during the information gathering phases. Mission support operations that may have used hazardous materials were given questionnaires to fill out listing estimated quantities of hazardous materials/hazardous wastes (HM/HW) historically used in their shops and methods of disposal. Figure 1.2 is a flow chart of the PA methodology.

Detailed geological, hydrological, and meteorological data, and population, land use, and environmental data for the area surrounding Hilo ANGS were obtained from appropriate Federal, State, and local agencies. A listing of outside agencies contacted is included in Appendix A.

DECISION TREE



SOURCE: ANGRC/CEVR, 1993.

FIGURE 1.2

PRELIMINARY ASSESSMENT METHODOLOGY CHART
291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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DECEMBER 1994

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SECTION 2.0 INSTALLATION DESCRIPTION

2.1 LOCATION

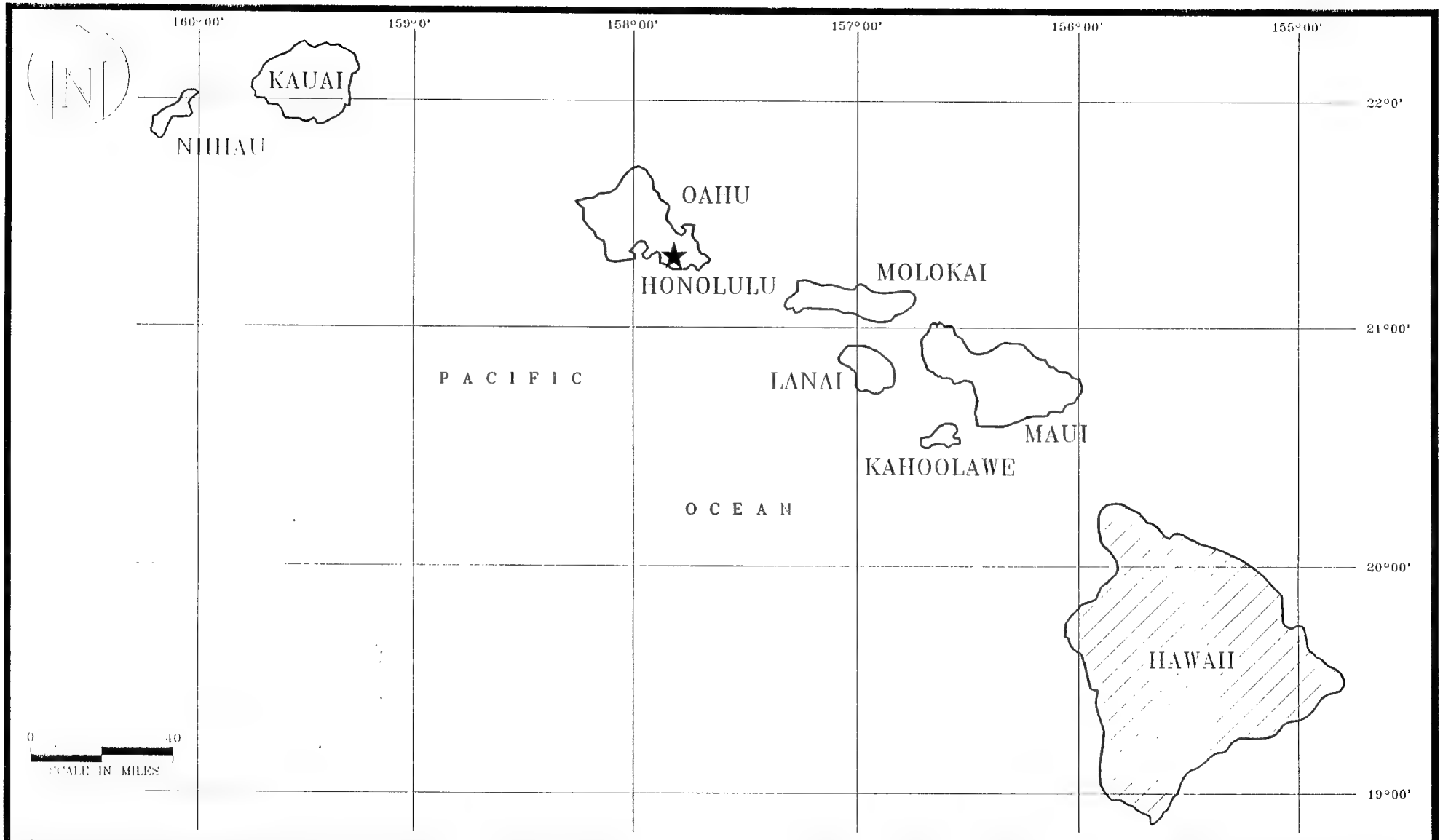
Hilo ANGS is located on the island of Hawaii, the southernmost island in the island chain (Figure 2.1). The Station is located at 1300 Kekuanaoa Avenue, off Puna Trail, approximately three miles southeast of the city of Hilo, Hawaii, and approximately one-half mile from the Hilo Airport (Figure 2.2). According to the 1990 U.S. census, the population of Hilo, the principal city of the island of Hawaii, is 37,808, while the population of the entire island (Hawaii County) is 120,317. Hilo ANGS, a 5.51-acre site, is owned by the State of Hawaii Department of Land and Natural Resources.

2.2 ORGANIZATION AND HISTORY

During World War II, over 2,000 acres of land was acquired by the U.S. Army and Navy southeast of Hilo, Hawaii. The Hilo Airport (subsequently named General Lyman Field) was contained within this area and subsequently became the site of U.S. Army Air Station and U.S. Naval Air Station facilities at Hilo Airfield during the war. Generally speaking, the Army facilities were located just south of the airfield east/west runway, and the Navy facilities were located south of those of the Army. According to a General Layout Plan of Army and Navy Facilities dated June 1944, the Hilo ANGS parcel was undeveloped land immediately south of a site which was formerly occupied by a U.S. Navy personnel barracks and a dispensary. These Naval facilities were demolished during the 1950s.

In 1952, the U.S. Government transferred General Lyman Field and the surrounding properties to the Territory of Hawaii. The Hilo ANGS at Keaukaha Military Reservation (KMR) was constructed in 1982 on 5.51 acres of land which is licensed to the Hawaii Air National Guard (HIANG) by the Department of the Air Force; the land is technically owned by the State of Hawaii Department of Land and Natural Resources (DLNR). The 291st CBCS relocated to the newly constructed Hilo ANGS in October 1982 from their former quarters located approximately 500 yards northwest, which were subsequently demolished.

The unit's mission is to provide command and control communications for tactical air forces and support of emergency U.S. Air Force (USAF) requirements for communications facilities. The normal population of the Hilo ANGS is 20 personnel. The population increases to approximately 120 during Unit Training Assembly (UTA) weekend training exercises.



SOURCE SOIL SURVEY OF THE ISLAND OF HAWAII, STATE OF HAWAII, 1973

FIGURE 2.1

HILO\ISLANDS

LOCATION OF THE ISLAND OF HAWAII IN THE STATE OF HAWAII

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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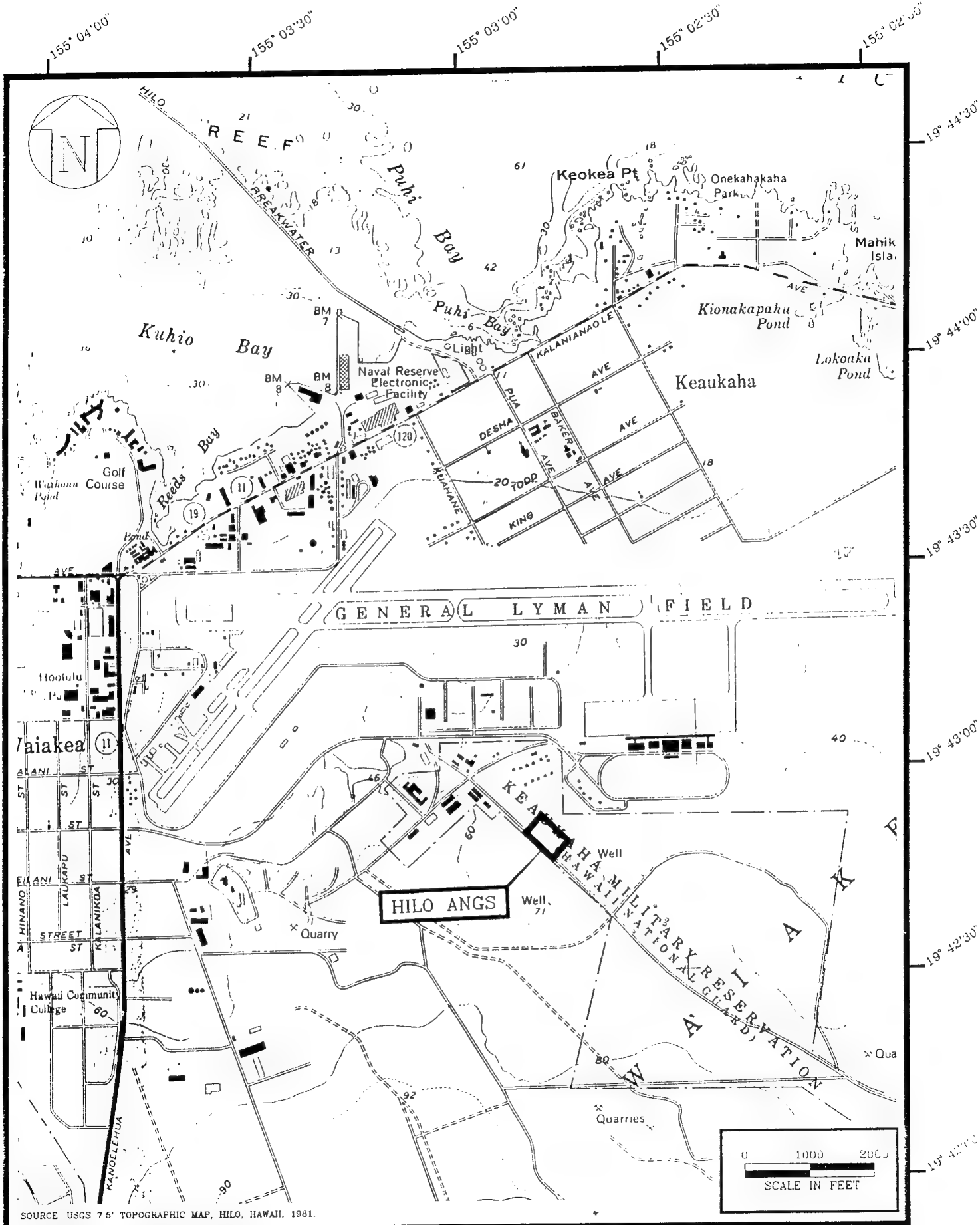

FIGURE 2.2

R:\HILO\75TOPO

STATION LOCATION MAP

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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Past and present ANG activities at the Station have involved the use of potentially hazardous materials and the disposal of potentially hazardous wastes. The major operations of the Station that use and dispose of hazardous materials and/or hazardous waste include vehicle operations, ANG vehicle maintenance, corrosion control, paint shop activities, and battery maintenance.

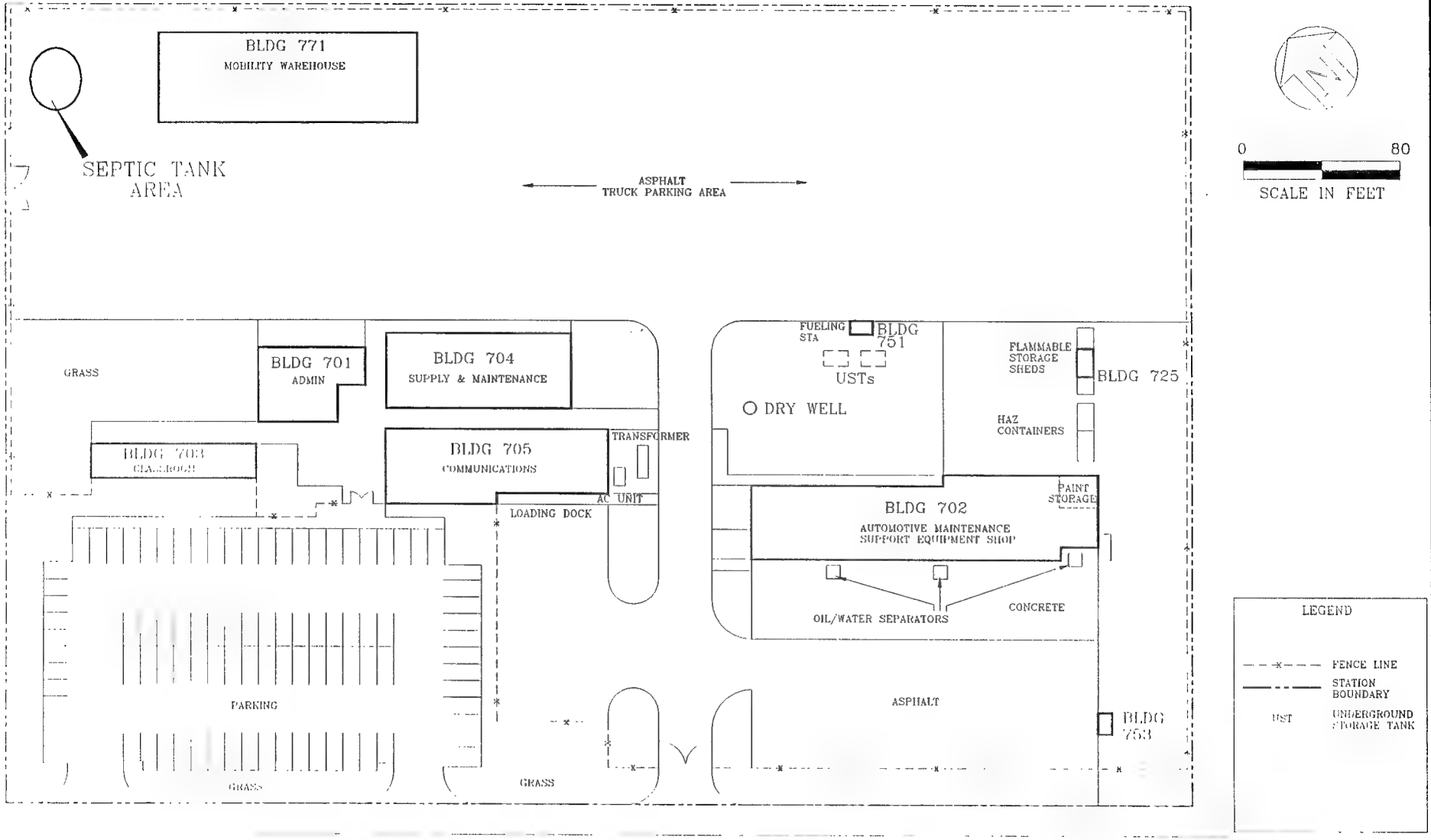
2.3 SIGNIFICANT STATION FACILITIES AND INFORMATION

The Hilo ANGS is completely fenced, with controlled access, and consists of the following buildings (see Figure 2.3):

- Building 701, the Administration Building, which constitutes a complex of several functional areas: a classroom (designated Building 703), supply and maintenance area (designated Building 704), and the communications area (designated Building 705);
- Building 702, which contains the automotive maintenance support equipment shop and paint bay;
- Building 725, a complex of several small buildings used for storage of flammable materials and hazardous waste containers;
- Building 751, which is the fueling station (gas and diesel pumps);
- Building 771, which is a mobility warehouse; and
- Building 753, which formerly served as a hazardous waste storage facility.

The Hilo ANGS sewage disposal system consists of a septic tank located in the north corner of the Station. Drinking water and electrical service are provided by Hawaii County utilities.

In support of Station operational mission requirements, two underground storage tanks (USTs) are located on Hilo ANGS. Both tanks were installed when the Station was constructed in 1982. Table 2.1 is an inventory listing of the USTs on the Station.



2-5

FIGURE 2-3

HILO HILO

SITE PLAN

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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Table 2.1
Underground Storage Tank Inventory
291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

Tank No.	Bldg. No.	Capacity (gallons)	Product	Construction	Year Installed	Current Status
1	751	1,000	MOGAS (unleaded)	Steel	1982	Active
2	751	1,000	Diesel fuel	Steel	1982	Active

MOGAS - motor gasoline

Precision leak testing was conducted by Tracer Research Corporation on the USTs for the years 1991, 1992 and 1993; both tanks and their associated piping successfully passed the leak detection testing.

SECTION 3.0 ENVIRONMENTAL SETTING

3.1 METEOROLOGY

3.1.1 Climatic Features

Among the 50 states, Hawaii is the only state surrounded by the ocean and the only one within the tropics. Both of these facts contribute significantly to its climate. The populated islands of the State are comprised of the easternmost members of the Hawaiian Island Chain. All of the islands are bordered by fringing coral reefs, and all have coasts that consist in part of sea cliffs, some of which are 300 to 3,000 feet in height.

The mountains, especially those of great height on Hawaii and Maui, strongly modify the marine effect and result in conditions that are semi-continental in some localities. The result is climatic conditions of great diversity. The most prominent feature of the circulation of air across the tropical Pacific is the tradewind flow in a general northeast-to-southwest direction.

In general, the Hawaiian climate is characterized by a two-season year, by mild and fairly uniform temperature conditions everywhere but at high altitudes, by strikingly marked geographic differences in rainfall, by generally humid conditions and high cloudiness except on the driest coasts and at high elevations, and by a general dominance of tradewind flow, especially at elevations below a few thousand feet. Except on high mountains, the general regime in Hawaii is one of high humidities, as compared with conditions in most other states.

3.1.1.1 Winds

The dominance of the tradewinds and the influence of terrain give special character to the climate of the islands. Tradewinds provide a system of natural ventilation much of the time throughout most of the State and bring to the land, at least in the lower lying regions, the mildly warm temperatures that are characteristic of air that has moved great distances across the tropical seas. Areas on the leeward (or "kona") coasts, with reference to the tradewinds and topographically sheltered from them, include the Kona Coast of Hawaii and the Barking Sands area of Kauai.

The wind conditions in Hawaii are exceedingly complex. Though the tradewinds are fairly constant in speed and though they blow a high percentage of the time across the adjacent sea and

onto the bordering lands, the relatively uniform tradewind flow is distorted and disrupted by the mountains, hills, and valleyways. In addition, there are local wind regimes along many of the coasts and on the mountain slopes.

Over the ocean around Hawaii, average windspeeds are highest during the summer tradewind period. During the summer months (May through October), the ocean winds exceed 12 miles an hour 50 percent of the time; 80 to 95 percent of the time these winds are from the northeast quadrant. During the winter (from November through April), when tradewinds are not quite as prevalent, windspeeds are in excess of 12 miles per hour about 40 percent of the time. When the tradewinds are moderate or strong--generally in excess of 14 miles per hour--they dominate the flow of air across wide reaches of the lowlands.

The prevailing winds on the island of Hawaii, as with the rest of the Hawaiian Islands, are the northeasterly trades which are present for much of the year. During tradewind weather, diurnal wind patterns occur. These patterns bring cooling breezes from the sea to replace the warmer air generated during the day over the coastal area. Major storms are chiefly events of the winter season, and they may yield very high winds from any direction. In any major, wind-producing storm, the extreme windspeeds may vary radically from one place to another, due both to the peculiarities of the storm, and to the effects of terrain. (Blumenstock and Price, 1974; Stearns, 1966)

3.1.1.2 Humidity and Cloudiness

Because of the diversity of valleys, hills, and mountains, the moisture distribution within the air that moves across Hawaii is far from uniform. Under tradewind conditions, there is very often a pronounced moisture discontinuity at heights of between 4,000 and 8,000 feet above sea level. In general, windward areas tend to be cloudier during the summer, when tradewind clouds are more prevalent, while leeward areas, which are less affected by tradewind cloudiness, tend to be cloudier during the winter, when general storms and frontal passages are more frequent. (Blumenstock and Price, 1974)

3.1.1.3 Precipitation

Among Hawaii's outstanding climatic features are the remarkable differences in rainfall over short distances. The principal cause of this remarkable variability is the orographic, or mountain-caused, rain that forms within the moist air from trade winds as it ascends and

traverses the steep and high terrain of the islands. The resulting rainfall distribution, in the mean, closely resembles the topographic contours. The amount is greatest over windward slopes and crests and is least toward the leeward lowlands.

The northeastern sides of the mountains are usually wettest because of the prevailing wind. Maximum precipitation occurs between altitudes of 2,000 and 6,000 feet, depending upon the form and height of each island. Above 6,000 feet the precipitation decreases, making high peaks semiarid. As the winds descend the lee slopes, they become warmer, drying winds, causing arid and semiarid climates on the leeward sides of the islands. The annual rainfall ranges from 10 inches or less on the lee coasts to about 450 inches on the wettest belts.

On the island of Hawaii, the zones of highest rainfall on the flanks of the large, high mountains of Haleakala, Mauna Loa, and Mauna Kea lie at elevations of 2,000 to 4,000 feet. Several times a year, on the average, and almost always between October and May, major storms may deposit a foot or more of snow on the upper slopes of one or more of Hawaii's highest mountains: Haleakala, Mauna Kea, and Mauna Loa.

The average rainfall in Hilo varies from about 113 inches in the summer season to 160 inches a year in the winter season. At Hilo, the average monthly rainfall for the winter season is 13.31 inches, while the average monthly rainfall for the summer season is 9.48 inches. The amount of rainfall recorded in the wettest month (March) was 15.45 inches, while the driest month (June) recorded 6.80 inches. In Hilo, the highest annual total was 207 inches of rainfall, the lowest 72 inches. Rainfall variability is far greater during the winter, when occasional storms contribute appreciably to rainfall totals, than during summer, when tradewind showers provide most of the rain. (Blumenstock and Price, 1974; Stearns, 1966)

Rainfall is the principal source of groundwater recharge. However, the distribution of rainfall is not the same in different island locales, and depends largely on the rainfall quantity and variability, and the absorption ability of the land surface. Of approximately 7,335 million gallons per day of rainfall which falls in the drainage basin which includes the Hilo area, approximately 24 percent is lost to evapotranspiration, 34 percent is runoff, and 42 percent is groundwater recharge. (Takasaki, 1978)

3.1.1.4 Temperatures

There are essentially two seasons in Hawaii, summer and winter. During the summer months, temperatures range from 70°F to 88°F and the weather is warm and dry. Northeasterly tradewinds are also present most of the time. During the winter season. the weather is cooler, and temperatures range from 60°F to 83°F. Elevation also affects the temperature. An increase of every 1,000 feet realizes a decrease in temperature of 4°F. The maximum temperature rarely exceeds 90°F, and the minimum hovers around 50°F.

Hilo, the principal city on the island of Hawaii, lies 40 feet above sea level in the windward lowlands on the east side of the island on Hilo Bay. In Hilo, July and August are the warmest months, with average daily highs and lows of 83°F and 68°F, while January and February, the coolest months, have highs of 80° and lows of 63°F. (Blumenstock and Price. 1974)

3.2 PHYSIOGRAPHIC SETTING

The island of Hawaii is 93 miles long and 76 miles wide, with an area of approximately 4,030 square miles. Hilo ANGS is located on the coastal plain near Hilo Bay on the east coast of the island at 19°43' North latitude and 155°03' West longitude. The island of Hawaii's dominant physiographic features are the large mountains of Mauna Loa and Mauna Kea.

3.2.1 Topography and Drainage

The Hilo ANGS is located approximately three miles southeast of the town of Hilo, the principal city of the island of Hawaii. The area topography slopes gradually north toward the Pacific Ocean. Hilo lies 40 feet above sea level in the windward lowlands on Hilo Bay, and elevation at Hilo ANGS ranges from approximately 60 feet above MSL in the west corner of the Station to approximately 52 feet at its lowest point at the east corner of the Station; the Station is not located in a flood-prone area.

The island of Hawaii's dominant physiographic features are the large mountain masses of Mauna Loa and Mauna Kea, both of which rise to over 13,000 feet above mean sea level (MSL) and both of which have suffered only slight erosion. The topography of the island reflects the volcanic activity. In the northern and eastern sections where volcanic flows have not occurred recently, the terrain has been eroded by rivers and streams. In the southern section the terrain is undissected, is quite barren, and reveals large areas of exposed lava.

The larger islands were subdivided into hydrographic areas by the Hawaii Water Authority in 1959. As shown in Figure 3.1, the boundaries of the areas are based on topography and generally outline the major surface drainage basins. (Takasaki, 1978)

Surface runoff across the Hilo ANGS is channeled to low areas of the installation at the north corner near the septic tank and toward the low area along a natural drainage swale along the east/southeast portion of the facility near the fence line. Figure 3.2 shows the surface water flow patterns across the Station.

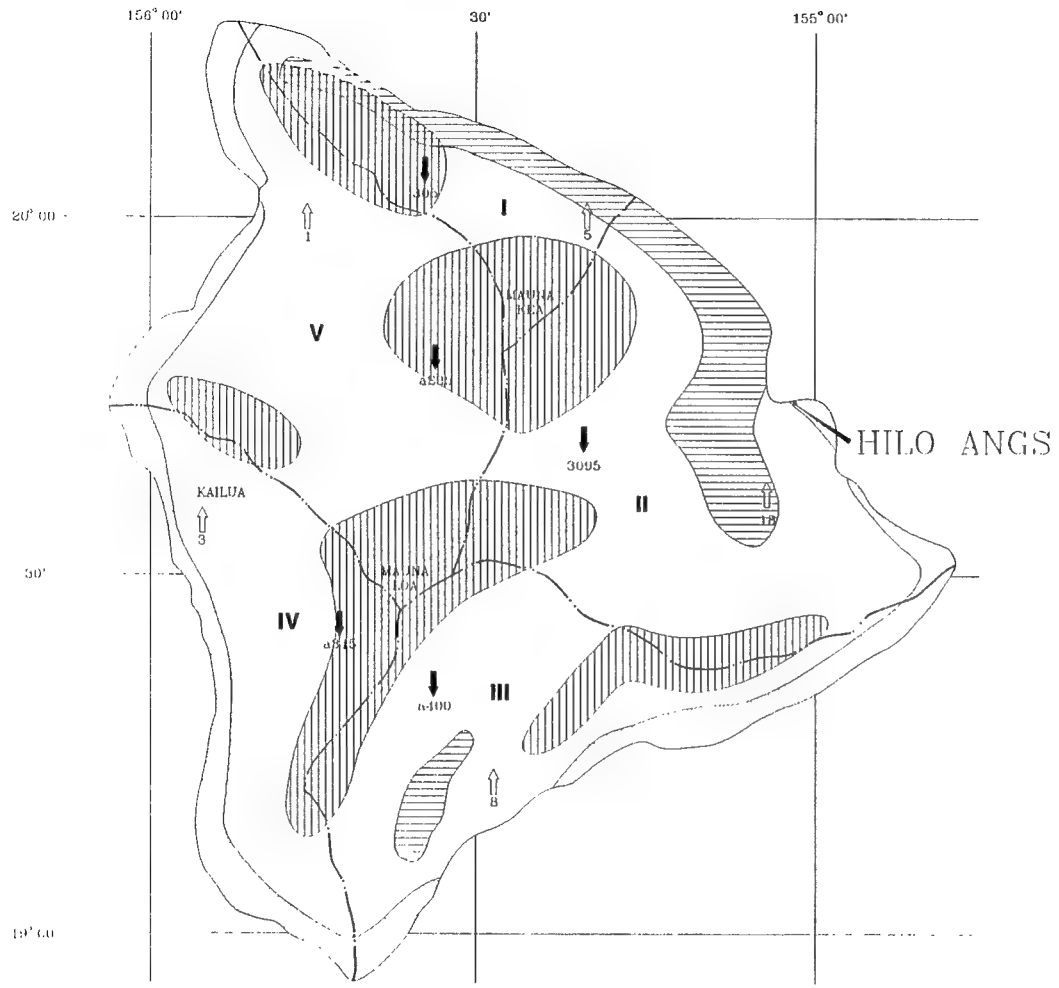
3.3 GEOLOGY

3.3.1 Regional Geology

The Earth's solid surface is divided into a dozen or so more or less rigid plates, 35 to 70 miles thick, which move laterally relative to each other over a zone of low rigidity in the upper part of the Earth's mantle. These plates have several types of boundaries, one being spreading boundaries in which adjacent plates are moving away from each other. These spreading boundaries lie mostly along the great series of ridges which girdle the Earth, largely on the ocean floors, and seismic activity along such ridges contributes to the source of new crustal material.

Hawaii is located within the Pacific Plate, and researchers agree that Hawaii is underlain by what is called a mantle plume. Mantle plumes are relatively narrow columns of hot mantle that rise from deep within the mantle. These plumes are found within plates and at divergent boundaries between plates. It has been recognized, on the basis of the degree of weathering and erosion, that the Hawaiian volcanoes decrease progressively in age from the northwest to the southeast, and it is believed that this is the result of the northwestward movement of the Pacific plate across a hot, magma-generating spot in the mantle, magma rising through the plate to form a volcano. The center of the plume underlying Hawaii is located close to Mauna Loa and Kilauea on the island of Hawaii. Radioactive dating of the lavas of Hawaiian volcanoes has confirmed the general southeastward decrease in age.

The Hawaiian Islands are a chain of shield-shaped basaltic domes built over a fissure 1,600 miles long in the ocean floor. The feature has existed since at least early Tertiary and probably longer. The lava now rises along tension cracks bounding blocks strung out linearly from southeast to northwest.



LEGEND

- GROUNDWATER RECHARGE, MILLION GALLONS PER DAY
- GROUNDWATER DRAFT, MILLION GALLONS PER DAY
- a — LOW RECHARGE RATE BECAUSE MOST GROUNDWATER IS ACCOUNTED FOR AS STREAMFLOW
- II — HYDROGRAPHIC AREA REPRESENTING MAJOR DRAINAGE BASIN
- GROUNDWATER IMPOUNDED BY DIKES OR OTHER STRUCTURES
- GROUNDWATER PERCHED ON SOIL, ASH, OR THICK LAVA FLOWS ABOVE BASAL GROUNDWATER
- BASAL GROUNDWATER FLOATING ON SALINE GROUNDWATER
- BRACKISH BASAL GROUNDWATER

0 10 20
SCALE IN MILES

SOURCE MODIFIED FROM TAKASAKI, 1978

FIGURE 3.1

LYMAN REGION

MAJOR DRAINAGE BASINS AND GROUNDWATER RESERVOIRS, ISLAND OF HAWAII

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Hilo Air National Guard Station
Hilo, Hawaii

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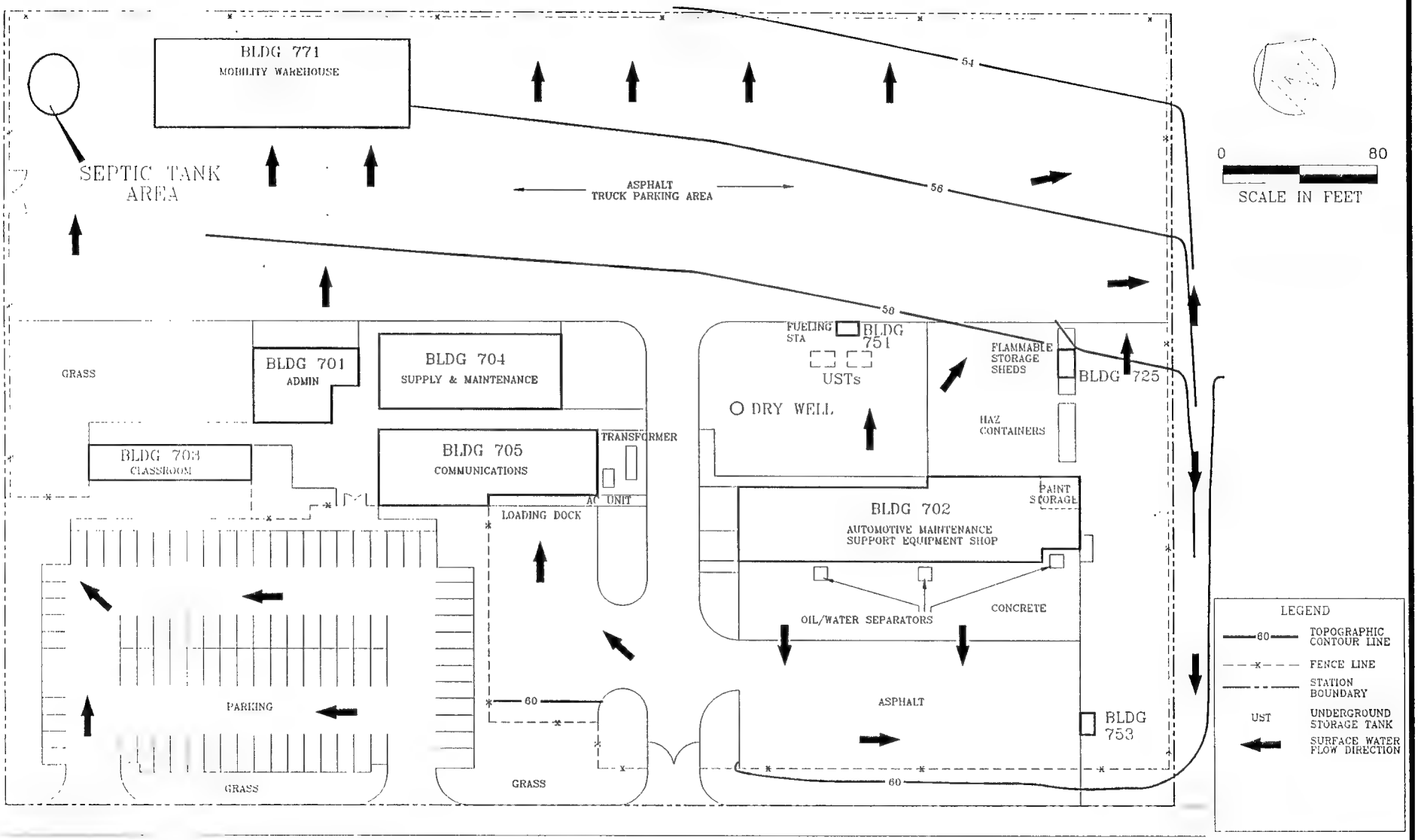

FIGURE 3.2

HILO\HILO

STATION - SURFACE DRAINAGE

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Hilo Air National Guard Station
Hilo, Hawaii

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The larger, high volcanic islands (including the island of Hawaii) probably were built above sea level in Pliocene time (see Geologic Time Scale in the Glossary). Periods of eruptions resulted in island building, and the following periods of volcano dormancy and erosion resulted in the formation of deep canyons and high cliffs, with soils 5 to 100 feet thick forming in some areas. A period of great submergence followed the long erosion period, and then a new epoch of volcanism began, with secondary outbreaks continuing into the Holocene (or Recent) Epoch.

Each of the islands consists of one to five volcanic domes, the bulk of which is composed of thousands of basaltic lava flows. The lavas issued in repeated outpourings from narrow zones of fissures associated with each volcano, first below sea level, then above it, to form huge mountain masses. The basaltic lavas that were extruded above sea level are generally thin-bedded, highly clinkery, and highly permeable. All of the islands have sunk, to some extent, to adjust isostatically for their great weight on the earth's crust. Consequently, the highly permeable lava flows, which were originally extruded above sea level, now extend some distance below it. This rock assemblage of highly permeable basaltic lava flows makes up the principal reservoirs for groundwater in the Hawaiian islands.

Fissure eruptions characterize Hawaiian volcanoes. Seismic records indicate that the magma starts rising from the mantle about 35 miles below the surface and forms a reservoir within the crust at a depth of several miles. From there it finds its way to the surface through narrow dikes (areas of igneous intrusion). The usual eruption is preceded by a local earthquake as the ground opens to allow the exit of the magma. The fissures are a few inches to a few feet wide, and, during the rapid dome-building epoch, are limited to definite rift zones. The widest single dike known in Hawaii is 40 feet across; the average width is about 2 feet. Eruptions often begin with a lava fountain which is caused by frothing at the top of the lava column when pressure on the enclosed gases is released. Rivers of pahoehoe pour from the fissure, but as it flows down the mountainside, the lava usually changes to Aa. Recorded eruptions have lasted from a few hours to 18 months, and the flows have ranged in length from a few feet to 35 miles.

Hawaiian eruptions are self-extinguishing because eruption of lava to the surface is far more rapid than its replenishment from the source far below. Exposed parts of the Hawaiian volcanoes contain by volume less than one-half of 1 percent of explosive debris, thus indicating the dominance of lava outpourings. The flows range from a few inches to 900 feet in thickness, but most are from 10 to 30 feet. The main bulk of the domes consists of lava beds dipping 3° to 10° away from their source and rarely separated even by thin soil beds. Thin soils between flows in some volcanoes show that the time interval between eruptions lengthened toward the

close of the dome-building epoch. Many of the soil beds are decomposed vitric tuff which, during the early phase of eruption, generally is deposited in small quantities by lava fountains near the vents.

Landscape features of volcanic origin may be either positive forms, the result of accumulation of volcanic materials, or negative forms, the result of lack of accumulation or of collapse. Both features are found in the State of Hawaii. Fissure eruptions which occur repeatedly along the same zone of fissures result in a broadly rounded dome-shaped hill or mountain known as a shield volcano. Shield volcanoes consist almost wholly of innumerable superimposed thin lava flows. Small bowl-shaped depressions formed by explosion are known as craters, and most of them are found on the flanks of volcanic cones. A larger depression at the summit of volcanic cones is formed by collapse of the summit as the support beneath it is removed by the rapid withdrawal of magma. A depression of this sort is called a caldera.

Phreatic and phreatomagmatic explosions have occurred sparingly in the Hawaiian Islands. Such violent explosions may throw dust and ash high into the stratosphere, where it may drift for thousands of miles (ash from eruptions of Iceland has fallen in the streets of Moscow). Most of the solid fragments in the cloud settle out within a few days, and nearly all within a few weeks, but some finely divided material may remain suspended in the stratosphere for more than a year. (McGraw-Hill Encyclopedia of the Geological Sciences, 1978; and The Encyclopedia of Structural Geology and Plate Tectonics, 1987)

3.3.2 Local Geology

The Island of Hawaii is geologically the youngest and the easternmost in the island chain. The island was built by lavas poured from five volcanoes--Mauna Kea, Mauna Loa, Hualalai Volcano, Kohala Mountain, and Kilauea Volcano. Only the two major volcanos, Mauna Kea and Mauna Loa, have impacted the local geology and are discussed here.

Mauna Kea, the highest of the volcanic domes at 13,784 feet, rises sharply to the northwest from the lowlands and is the source of the Hamakua volcanic series of primitive olivine basalts during the early Pleistocene. The dome is 30 miles across and studded with cinder cones, most of which are near the top and clustered into zones, indicating that the volcano was built over rifts trending eastward, southward, and westward. The volcanics of Mauna Kea are divided into two series. The older forms the major part of the mountain and is chiefly primitive olivine basalts, while the younger series are all andesites. Mauna Kea became extinct during the Holocene

(Recent) epoch. Rocks of the Hamakua volcanic series, capped by Pahala ash, are found north and west of Hilo.

Mauna Loa, an active volcano which lies southwest of Hilo, is a shield-shaped dome about 60 miles long and 30 miles wide and is one of the most prolific lava producers on earth. The caldera resulted from collapse and is growing broader through coalescence with adjacent pit craters. During the past 150 years, Mauna Loa has averaged one outbreak in the caldera every four years, and has produced a lava flow every seven years. Most eruptions start as high, short-lived lava fountains in the caldera, then change to outpourings of lava from vents at lower altitudes along the rifts.

The rocks of Mauna Loa are divided into three units, all olivine basalts. The oldest, the Ninole volcanic series, forms the core of the mountain. Overlying the Ninole lavas are the Kahuku volcanic series, which is then overlain by the Kau volcanic series. The prehistoric lava member flows were extruded from late Pleistocene to Recent prehistoric times, while the historic member of the Kau volcanic series comprises the lavas erupted since 1832. The stratigraphic rock units in the island of Hawaii are shown in Table 3.1.

The Hilo ANGS area was built by lava flows from Mauna Loa, and the Kau volcanic series found in the area are a result of such eruptions (see Figure 3.3). The Kau volcanic series are fairly fresh lavas, commonly bare and rocky in dry areas and rarely more than 25 feet thick, except in the upper part of Mauna Loa where they exceed 800 feet in thickness.

Moana Loa has poured out numerous flows, the longest historical flow in 1859 which was 33 miles long and lasted 10 months. These prehistoric and historic lavas, from the late Pleistocene and Recent epochs, are found in the southern and eastern sections of Hilo. During another eruption in 1881, lava stopped in the outskirts of Hilo after flowing 29 miles. An eruption of Moana Loa in 1940 extruded lava at a rate of 2,600,000 cubic yards per hour. The lavas include porphyritic and nonporphyritic. Aa .and pahoehoe basalts. Olivine and feldspar phenocrysts are abundant in the basalts. In addition, lava tubes and minor structures typical of recent lava flows are common. (Stearns, 1966)

3.3.3 Soils

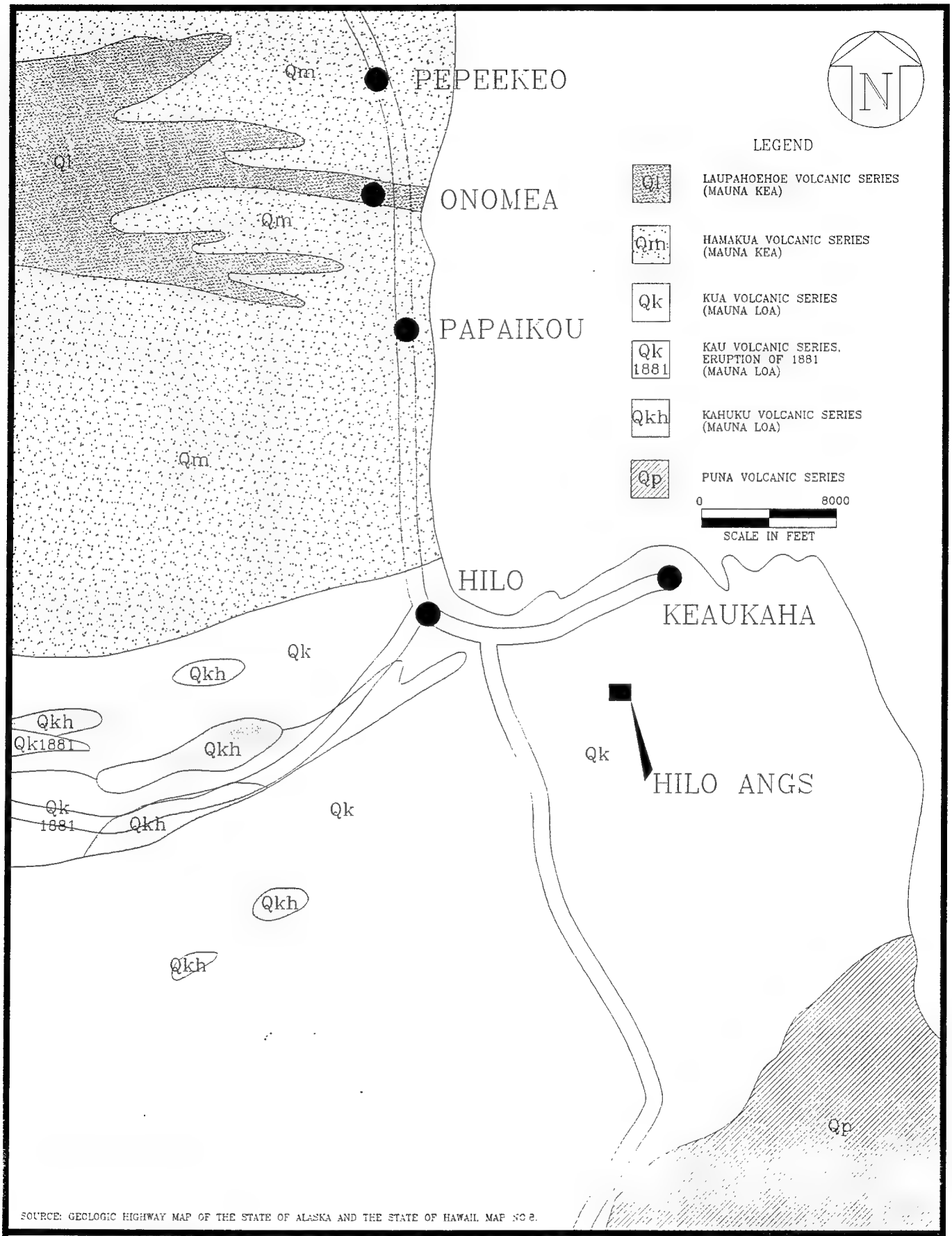
Soils classified at the site by the U. S. Department of Agriculture Soil Conservation Service (SCS) include lava flows and units of the Papai series.

Table 3.1
Stratigraphic Rock Units in the Island of Hawaii

<table>
<tr><th>Age</th><th>Hualalai</th><th>Kohala Mountain</th><th colspan="2">Mauna Loa</th><th>Kilauea</th><th colspan="2">Mauna Kea</th></tr>
<tr><td>Historic</td><td>Historic member of the Hualalai volcanic series (1800-01)</td><td rowspan="2">Unconsolidated alluvium, dunes and landslides</td><td>Historic member of volcanic series (1832-1950)</td><td>Mud flow of 1868</td><td>Historic member of the Puna volcanic series (1790-1965)</td><td></td><td rowspan="2">Ribbons of gravel and small alluvial fans</td></tr>
<tr><td>Recent</td><td rowspan="3">Prehistoric member of the Hualalai volcanic series</td><td colspan="2" rowspan="2">Dunes</td><td rowspan="2">Dunes</td><td>Upper member of the Laupahoehoe volcanic series</td></tr>
<tr><td rowspan="3">Late Pleistocene</td><td rowspan="2">Fluvial conglomerates</td><td colspan="2" rowspan="2">Prehistoric member of the Kau volcanic series</td><td rowspan="2">Prehistoric member of the Puna volcanic series</td><td colspan="2">Glacial debris and fluvial conglomerates</td></tr>
<tr><td colspan="2">Lower member of the Laupahoehoe volcanic series</td></tr>
<tr><td>Pahala ash (exposed on Waawaa volcanics only)</td><td>Pahala ash (not differentiated)</td><td colspan="2" rowspan="2">Pahala ash</td><td rowspan="2">Pahala ash</td><td colspan="2">Local erosional unconformity</td></tr>
<tr><td>Early and middle Pleistocene</td><td rowspan="3">Waawaa volcanics and lower unexposed part of Hualalai volcanic series</td><td>Fluvial conglomerates</td><td colspan="2" rowspan="2">Kahuku volcanic series</td><td colspan="2" rowspan="2">Pahala ash</td></tr>
<tr><td>Hawi volcanic series</td><td rowspan="2">Hilina volcanic series</td></tr>
<tr><td>Early Pleistocene</td><td colspan="2">Great erosional unconformity</td><td colspan="2">Hamakua volcanic series</td></tr>
<tr><td></td><td></td><td>Pololu volcanic series</td><td colspan="2">Ninole volcanic series</td><td></td><td colspan="2"></td></tr>
</table>

Note: The volcanic rocks of Mauna Loa, Mauna Kea, and Hualalai, those of Mauna Kea and Kohala, and those of Mauna Loa and Kilauea interfinger.

Source: Stearns, H.T., Geology of the State of Hawaii, 1966.



SOURCE: GEOLOGIC HIGHWAY MAP OF THE STATE OF ALASKA AND THE STATE OF HAWAII, MAP NO 2.

FIGURE 3.3

LYMAN SOILMAP

GEOLOGIC MAP
291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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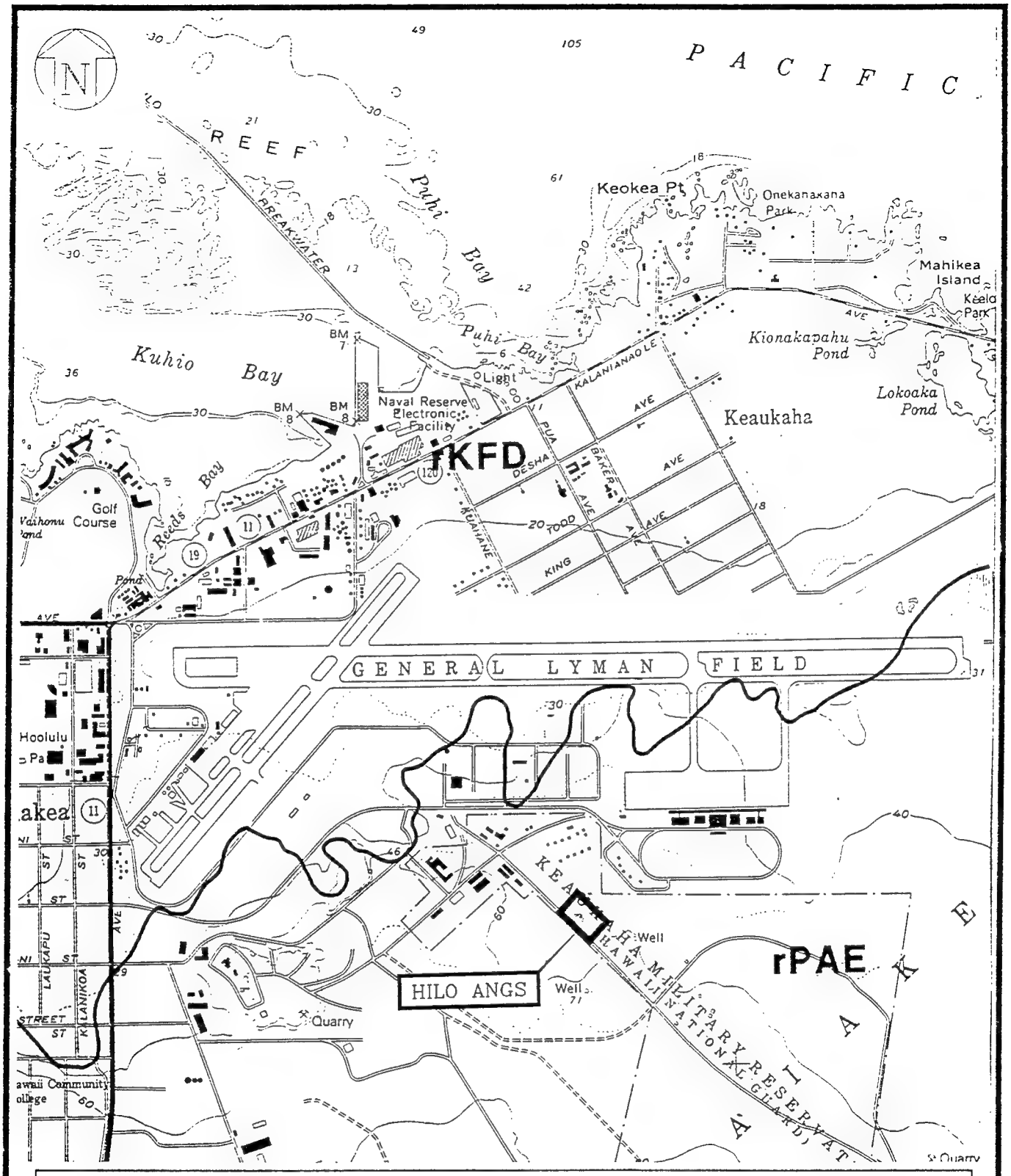
The Papai series consists of well-drained, thin (from 2 to 12 inches deep), extremely stony organic soils over fragmental Aa lava. These soils are gently sloping to moderately steep. They are on uplands at an elevation ranging from near sea level to 1,000 feet and receive from 90 inches to more than 150 inches of rainfall annually. Papai extremely stony muck (rPAE), 3 to 25 percent slopes, is the soil type found at the Hilo ANGS (see Figure 3.4). This soil is found low on the windward side of Mauna Kea. The surface layer is very dark brown, extremely stony muck about 8 inches thick and is slightly acid. It is underlain by fragmental Aa lava bedrock found at 0 to 1 foot depth. Soil permeability is rapid, runoff is slow, and the erosion hazard is slight. The Papai series soils are used mostly for woodland. Small areas are used for pasture, orchards, and truck crops. (U. S. Department of Agriculture. Soil Conservation Service)

3.4 HYDROLOGY

3.4.1 Groundwater

Groundwater is Hawaii's most valuable mineral resource. Over 90 percent of the State's drinking water comes from underground sources. It takes approximately one ton of water to produce one pound of sugar, and the islands produce more than one million tons of sugar a year. Groundwater development is generally most favorable in areas directly downslope from mountain areas of high rainfall and becomes less favorable with increasing distance away from these downslope areas. Seawater is the biggest pollutant of freshwater, and many of the islands' groundwater problems are associated with the encroachment of saline water induced by development. As a result of development, the quality of the groundwater has deteriorated at some places, but water of less than potable quality can be tolerated in uses such as cooling and irrigation of sugarcane.

The principal fresh groundwater reservoirs consist of thin-bedded basaltic lava flows: the permeability of basalts exceeds that of most other rocks on earth. The potential yield from the basaltic lava flows is due to interstitial spaces in the basalt, cavities between beds, shrinkage cracks, lava tubes, and gas vesicles. Some lava tubes are 30 feet in diameter and, where they occur in the zone of saturation, are capable of transmitting vast quantities of water. The groundwater reservoirs contain interconnected water bodies that are impounded by dikes in the interior of the islands or are in dynamic equilibrium with the underlying saline groundwater in the outer rims of the islands. Groundwater in these settings is referred to, respectively, as dike-impounded water and basal water. (Stearns, 1966)



SOURCE: USGS 7.5' TOPOGRAPHIC MAP, HILO, HAWAII, 1961, AND MODIFIED FROM SOIL CONSERVATION SERVICE SOIL SURVEY OF ISLAND OF HAWAII, 1973.

FIGURE 3.4

HILO\SOIL

SOILS MAP
291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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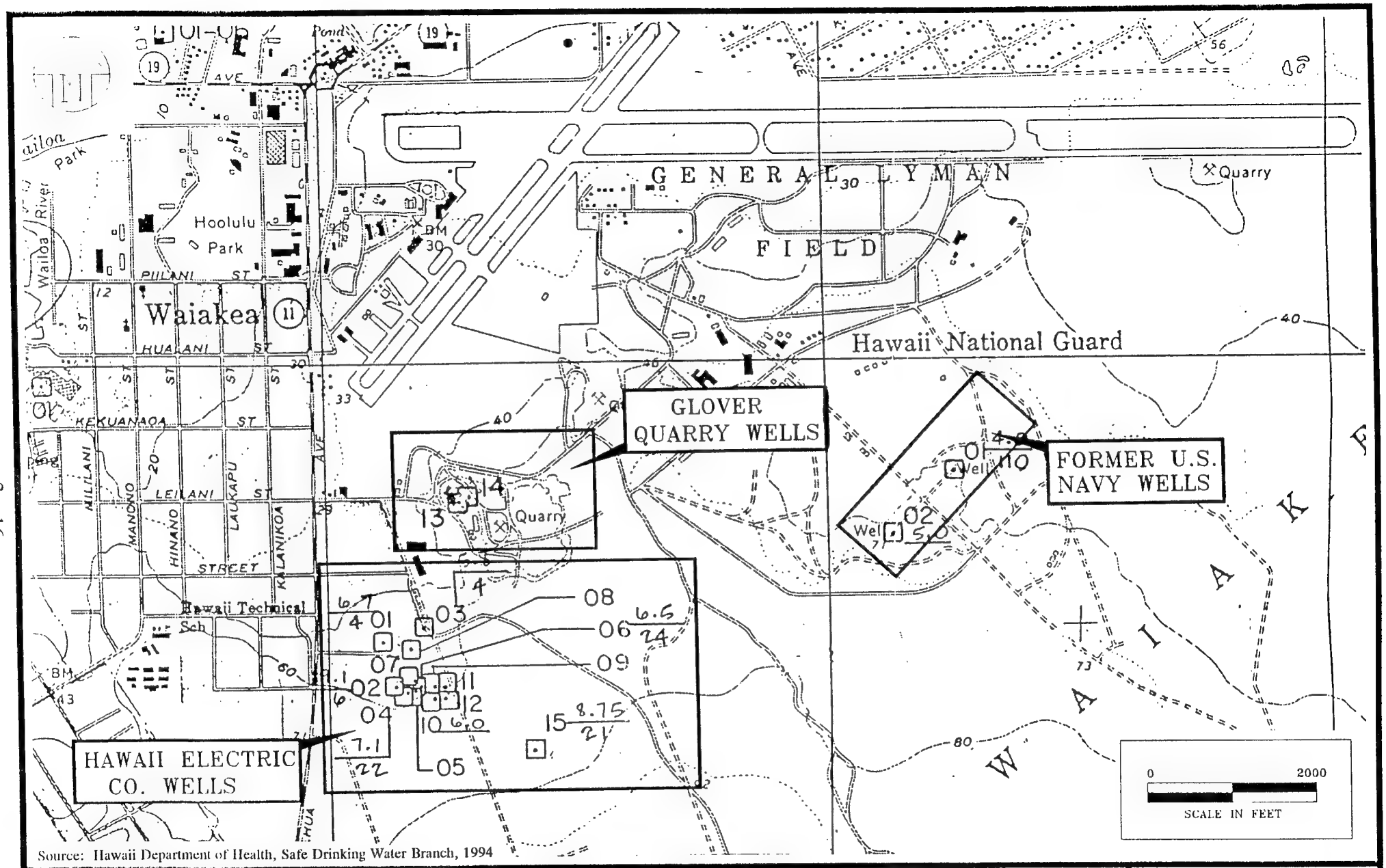
Groundwater underlying the Hilo ANGS occurs as brackish basal water in the highly permeable Kau volcanic series lavas. The basal-water lens is maintained by recharge, which, if reduced, leads to thinning of the lens and subsequent encroachment of seawater. Estimates of groundwater recharge and withdrawals, or draft, from the hydrographic area in which Hilo is located are included in Figure 3.1. (Stearns, 1966; and Takasaki, 1978)

Although there are no active drinking water supply wells within a one-mile radius of the Station, the locations of wells in the surrounding area are shown in Figure 3.5, with well information provided in Table 3.2. The first two wells listed in the table are former drinking water wells located approximately 750 feet southeast and southwest of the Hilo ANGS. The wells, now abandoned, were built in 1944 by the U.S. Navy and supplied the U.S. Army and U.S. Naval Stations at General Lyman Field during World War II. The wells were drilled to 55 and 76 feet below ground surface. When the wells were active, one well pumped 900 gallons per minute (gpm), while the second well pumped 1,000 gpm, and static water levels were measured at 4 and 5 feet above sea level (DLNR Groundwater Index and Summary, July 14, 1992). A 500,000-gallon water storage tank and pumping station were located across Puna Trail from the current Station. Both wells were closed in the 1950s when, due to the large volumes of water consumed by the military facilities, the aquifer was depleted and saline water encroached. A well test conducted by the County Water Department in October 1948 revealed salinity readings of 300 parts per million (ppm). Subsequently, the water mains and piping from the wells to the old Naval barracks and dispensary located immediately north of the present Station were removed.

Potable water in the area is obtained from groundwater sources. The closest current drinking water supply well is located in Panaewa, approximately three miles southwest of Hilo ANGS. (State of Hawaii Department of Health, Safe Drinking Water Branch, and Department of Land and Natural Resources, Commission on Water Resource Management)

3.4.2 Surface Water

In Hawaii, groundwater resources offer better prospects for supplying water needs than surface water resources. Most of the surface supplies that are easy to develop have been fully utilized where needed, and conduits and reservoirs necessary to develop new or additional supplies would generally require large and perhaps prohibitive outlays of capital.



Source: Hawaii Department of Health, Safe Drinking Water Branch, 1994

FIGURE 3.5

HILO\LOCWELLS

LOCATION OF WATER WELLS

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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Table 3.2
Water Wells in the Area of the 291st CBCS, Hilo ANGS
Hilo, Hawaii

Well Number	Well Description	Total Depth (feet)	Static Water Level (feet AMSL)	Pumping Rate[1] (gpm)	Well Use/ Status
8-4202-01	U.S. Navy	76	4	900	Unused
8-4202-02	U.S. Navy	55	5	1,000	Unused
8-4203-01	Hawaii Electric	54	6.7	36	Unused
8-4203-02	Hawaii Electric	55	9.1	50	Unused
8-4203-03	Hawaii Electric	56	5.8	50	Lost
8-4203-04	Hawaii Electric	201	7.1	4,660	Sealed
8-4203-05	Hawaii Electric	200	N/A	N/A	Industrial
8-4203-06	Hawaii Electric	200	6.5	6,500	Industrial
8-4203-07	Hawaii Electric	585	N/A	N/A	Industrial
8-4203-08	Hawaii Electric	33	N/A	N/A	Disposal
8-4203-09	Hawaii Electric	210	6.0	N/A	Industrial
8-4203-10	Hawaii Electric	210	6.0	6,100	Industrial
8-4203-11	Hawaii Electric	20	6.0	5,800	Disposal
8-4203-12	Hawaii Electric	210	6.0	6,000	Industrial
8-4203-13	Glover Quarry	25	N/A	N/A	Industrial
8-4203-14	Glover Quarry	25	N/A	N/A	Industrial
8-4203-15	Hawaiian Host	130	8.8	250	N/A

Source: State of Hawaii, Department of Health, Safe Drinking Water Branch and Department of Land and Natural Resources, Commission on Water Resource Management

[1] Maximum test pumping rate in gallons per minute.

AMSL – Above mean sea level.
N/A – Information not available.

Hawaiian streams, in general, are short and steep, and runoff depends largely on the intensity and duration of rainfall. Where rainfall is plentiful and well distributed during the year, as in the wet interior mountains, streams are generally perennial and abundant. Where rainfall is light, as in the dry leeward areas, streams are ephemeral and flow only at infrequent intervals during heavy storms. In areas where the infiltration capacity of the surface rocks is especially high, most rainfall is quickly absorbed, and there may be no runoff, except during intense

storms. The permeability of the younger volcanoes is so great that no runoff occurs, and no well-defined stream channels exist even though rainfall may exceed 200 inches per year. In the State of Hawaii, surface water is so undependable that only a few small hydroelectric plants are operated on Kauai and Hawaii. According to an appraisal of groundwater resources in the Hilo area, groundwater reserves are a large, little-tapped source, and thus surface water is not commonly utilized except for irrigation. Water used for irrigation is stored in small reservoirs and in a complex of tunnel and ditch systems used to carry water to crops. (Stearns, 1966)

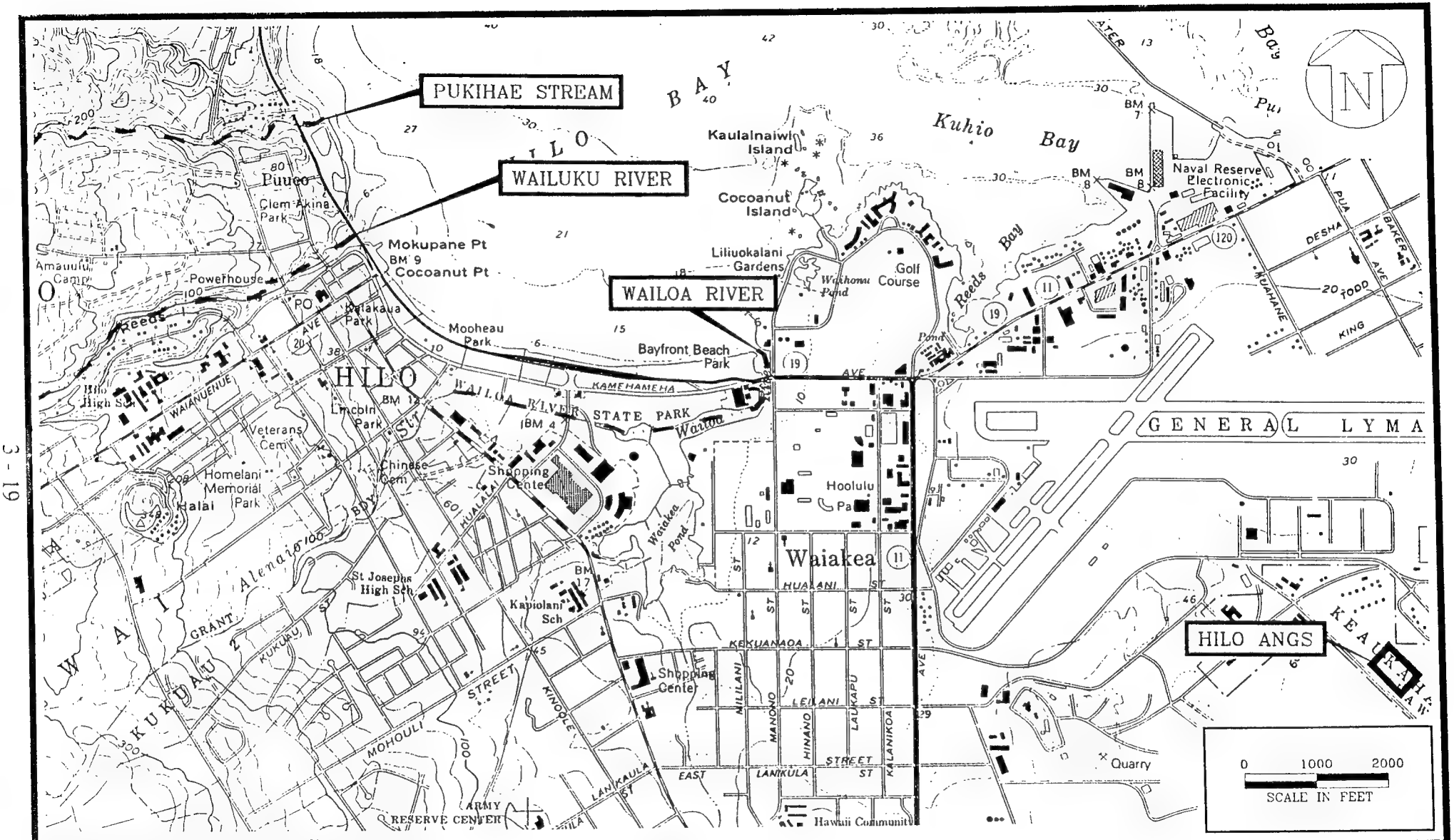
Although not located in the immediate area of the Hilo ANGS, numerous small ponds and marshy areas lie in close proximity to the bayfronts of Hilo and Puhi Bays, and several rivers and streams, which originate in the steep mountains west of Hilo, empty into Hilo Bay (see Figure 3.6). (National Wetlands Inventory, U.S. Department of the Interior, Fish and Wildlife Service)

3.5 CRITICAL HABITATS/ENDANGERED OR THREATENED SPECIES

According to information contained in the Final Environmental Impact Statement conducted prior to the construction of a passenger terminal at the Hilo Airport and the DERP Inventory Project Report for Formerly Used Sites which was conducted for the former military facilities located at General Lyman Field, there are no known rare or endangered species which inhabit this area. During the site visit conducted for the Inventory Project Report in November 1990, evidence of feral pigs was noted, and various species of urban birds were observed. Flora noted during the site visit consisted of screwpine, banyan, coconut palm, and numerous ferns and grasses.

According to records of the U. S. Fish and Wildlife Service, Pacific Islands Ecoregion, however, the following endangered species may exist within an approximate 5-mile radius of the Hilo ANGS:

Species	**Remarks**
<u>Mammal</u>	
Hoary bat	Last sighted in area in 1992
<u>Birds</u>	
Hawaiian coot	Last sighted in area in 1989
Hawaiian duck	Last sighted in area in 1990
Hawaiian hawk	Last sighted in area in 1992
O'u	Extremely rare; last noted in the area in 1878



SOURCE: USGS 7.5' TOPOGRAPHIC MAP, HILO, 1981

FIGURE 3.6

HILO.SURF

SURFACE WATER MAP

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

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Invertebrates

Orange black megalagrion damselfly	Candidate for endangered listing; found in marshes and pools near the Hilo Airport

Plants

Asplenium fragile var. *insulare*	Last sighted in the area in 1910
Hilo ischaemum (*Ischaemum byrone*)	Last sighted in the area in 1992
Stenogyne angustifolia	Last sighted in the area in the 1800s
Kihi (*Adenophorus periens*)	Proposed endangered; last sighted in the area in 1889

Based on surveys conducted in 1990 by the State of Hawaii, three waterways within a 5-mile radius--Pukihae Stream, the Wailuku River, and the Wailoa River--contain the native freshwater goby *Awaous stamineus*, and Pukihae Stream and the Wailuku River also contain the native freshwater goby *Sicyopterus stimpsoni*. These waterways are also shown in Figure 3.6.

The Pacific Ocean lies approximately a mile from the Hilo ANGS, and species which may be found in the marine environment near the area include the threatened green turtle *Chelonia mydas*, and endangered hawksbill turtles (*Eretmochelys imbricata*), Hawaiian monk seals (*Monachus schauinslandi*), and humpback whales (*Megaptera novaeangliae*). Because the Hilo ANGS is so far removed from the marine environment, no effect to any listed species as a result of activities conducted at the Station is anticipated. (National Marine Fisheries Service)

SECTION 4.0 AOC EVALUATION

4.1 BACKGROUND WASTE GENERATION

During meetings conducted at Hickam AFB and Fort Ruger, and the ensuing Station visit, interviews were completed with 18 personnel who were familiar with Hilo ANGS operations which have used hazardous materials or have generated hazardous waste at the Station.

Since Hilo ANGS was built in 1982, waste oils and solvents have been stored in separate drums. Storage of these drums has been at several locations in the southeast portion of the Station. Currently, a small shed, utilized for flammable materials storage, and two metal hazardous waste storage buildings are located adjacent to and east of Building 702. The historical disposition of hazardous wastes at the Hilo ANGS is shown in Table 4.1.

Table 4.1
Inventory of Hazardous Materials Used at Hilo ANGS
291st CBCS, Hilo ANGS, Hilo, Hawaii

Shop	Possible Waste Materials	Quantities/Disposed Gallons/year	Methods of Disposal	
			1980s	Present
Vehicle Maintenance	Parts Cleaner	4	CIV	CIV
	Sulfuric Acid	30	NEUT SAN	CIV
	Hydraulic Oil	5	CIV	CIV
	Asbestos	5 lbs	COUNTY	COUNTY
	Motor Oil	30	CIV	CIV
	Oil Filters	15 lbs	COUNTY	CIV
	Brake Fluid	1	CIV	CIV
Corrosion Control	Lacquer Aerosol	8 cans	COUNTY	COUNTY
Paint Shop	Paint Containers (Residual)	1-gal size	COUNTY	COUNTY
	Thinners	5	CIV	CIV

gal – gallons.
lbs - pounds.
CIV - Disposed of through Civilian Contractor.
COUNTY - Disposed of at dumpster.
NEUT SAN - Neutralized and disposed in drain leading to septic tank.

Three oil/water separators are located on the Station. These oil/water separators are located on the west (front) side of Building 702, the automotive maintenance facility. The oil/water separators were utilized during the Station's early years. However, they are not currently used and are severely deteriorated; they have been cleaned of sludge materials and the floor drains sealed. Plans call for the oil/water separators to be removed or filled with sand.

A dry well is located east (in the rear) of Building 702. The well was constructed of radial layers of rock and is open-ended at the bottom. Gutters leading from Station building roofs carry rainwater from the spouts into the dry well. Roof rainwater drainage has been the sole function of the dry well, and no other materials or wastes have been disposed in the dry well.

The Station contains two USTs: a 1,000-gallon steel UST containing unleaded gasoline and a 1,000-gallon steel UST containing diesel fuel. Both tanks were installed when the Station was constructed. Leak tests conducted on both tanks in 1991, 1992 and 1993 by Tracer Research Corporation show that both tanks and their associated piping successfully passed the test each year. Plans call for the replacement of the USTs by aboveground storage tanks.

4.2 AOC DESCRIPTION, EVALUATION AND HAZARD ASSESSMENT

No formal areas of concern at Hilo ANGS have been identified for further investigation.

SECTION 5.0 CONCLUSIONS

No AOCs will be further investigated.

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SECTION 6.0 RECOMMENDATIONS

No further IRP investigation is warranted since no formal AOCs have been identified.

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GLOSSARY OF TERMS

AA - A Hawaiian term for lava flows typified by a rough, jagged, clinkery surface.

ALLUVIAL - Pertaining to or composed of alluvium or deposited by a stream or running water.

ALLUVIUM - A general term for detrital deposits made by streams on river beds, flood plains, and alluvial fans. The term applies to stream deposits of recent time.

ANDESITE - A dark-colored, fine-grained extrusive rock.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

AQUIFER - A body of rock that is sufficiently permeable to conduct groundwater and yield economically significant quantities of water to wells and springs.

ARTESIAN - A hydrologic condition whereby groundwater is confined, under pressure greater than atmospheric, by overlying, relatively impermeable strata.

ASH – Fine pyroclastic material (under 2.0-millimeter diameter).

BASALT - A dark-colored igneous rock, commonly extrusive, composed primarily of calcic plagioclase and pyroxene; the fine-grained equivalent of gabbro.

BASIN - (a) A depressed area with no surface outlet; (b) A drainage basin or river basin; (c) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated.

BAY - A wide, curving open indentation, recess, or inlet of a sea or lake into the land or between two capes or headlands, larger than a cove, and usually smaller than, but of the same general character as a gulf.

BED (stratigraphy) - The smallest form of a unit in the hierarchy of lithostratigraphic units. In a stratified sequence of rocks, it is distinguishable from layers above and below. A bed commonly ranges from a centimeter to a few meters.

BEDDING (stratigraphy) - The arrangement of sedimentary rock in beds or layers of varying thickness and character.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

BRECCIA – A coarse-grained clastic rock composed of angular broken rock fragments held together by a mineral cement or in a fine-grained matrix.

GLOSSARY OF TERMS (Continued)

CALCAREOUS - Containing calcium carbonate. When applied to a rock name, it implies that as much as 50% of the rock is calcium carbonate.

CALDERA - A large basin-shaped volcanic depression.

CINDER CONE – A conical hill formed by the accumulation of cinders and other pyroclasts, normally of basaltic or andesitic composition.

CLASTIC - Pertaining to a rock or sediment composed principally of fragments derived from pre-existing rocks or minerals and transported some distance from their places or origin.

CLAY (soil) - A rock or mineral particle in the soil having a diameter less than 0.002 mm (*2 microns).

CLAY (geol) - a rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

COARSE-TEXTURED (light textured) SOIL - Sand or loamy sand.

CONFINED AQUIFER - An aquifer bounded above and below by impermeable beds, or by beds of distinctly lower permeability than that of the aquifer itself.

CONGLOMERATE - A coarse-grained sedimentary rock, composed of rounded pebbles, cobbles, and boulders, set in a fine-grained matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica, or hardened clay.

CONSOLIDATION - Any process whereby loosely aggregated, soft, or liquid earth materials become firm and coherent rock; specifically the solidification of a magma to form an igneous rock or the lithification of loose sediment to form a sedimentary rock.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but is not limited to any element, substance compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly be ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms of their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquified natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CORAL REEF - A coral-algal or coral-dominated mound or ridge of in-place coral colonies and skeletal fragments, carbonate sand, and organically secreted calcium carbonate.

CRITICAL HABITAT - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (1) essential to the conservation of the species, and (2) which may require special management consideration or protection.

DEPOSITS - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DIKE - A tabular body of igneous rock that cuts across the structure of adjacent rocks or cuts massive rocks.

DRAINAGE CLASS (natural) - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well-drained - Water is removed from the soil somewhat readily, but not rapidly. it is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well-drained soils are commonly medium textures. They are mainly free of mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the soil, or periodically receive high rainfall or both.

Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very Poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

GLOSSARY OF TERMS (Continued)

DRAINAGEWAY - A channel of course along which water moves in draining an area.

DUST (volc) – A synonym of volcanic ash, especially the finer fractions of ash.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

EROSION - The general process or the group of processes whereby the materials of the earth's crust are loosened, dissolved, or worn away, and simultaneously moved from one place to another by natural agencies, but usually exclude mass wasting.

ERUPTION - The ejection of volcanic materials (lava, pyroclasts, and volcanic gases) onto the earth's surface, either from a central vent or from a fissure or group of fissures.

FAULT - A fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.

FELDSPAR - A group of abundant rock-forming minerals; the group is the most widespread of any mineral group and may constitute 60% of the earth's crust, occurring in all types of rock.

FINE-GRAINED - Said of a soil in which silt and/or clay predominate.

FINE-TEXTURED SOIL - Sandy clay, silty clay, and clay.

FLOOD PLAIN - That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stage.

FOLD - A curve or bed of a planar structure such as rock strata, bedding planes, foliation or cleavage.

FORMATION - A lithologically distinctive, mappable body of rock.

FRACTURE (structural geology) - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure be stress. Fracture includes crack, joints, and faults.

GABBRO - A group of dark-colored, basic intrusive igneous rocks composed principally of basic plagioclase; approximate intrusive equivalent of basalt.

GEOLOGIC TIME - See Figure GL.1.

GRABEN – An elongate, relatively depressed crustal unit or block that is bounded by faults on its long sides; it may also be known as a "rift vailey."

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

GROUNDWATER DRAFT – Groundwater withdrawn from the subsurface.

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS SUBSTANCE - CERCLA hazardous substances, pollutants, and contaminant as defined in CERCLA sections 101(14) and 101(33).

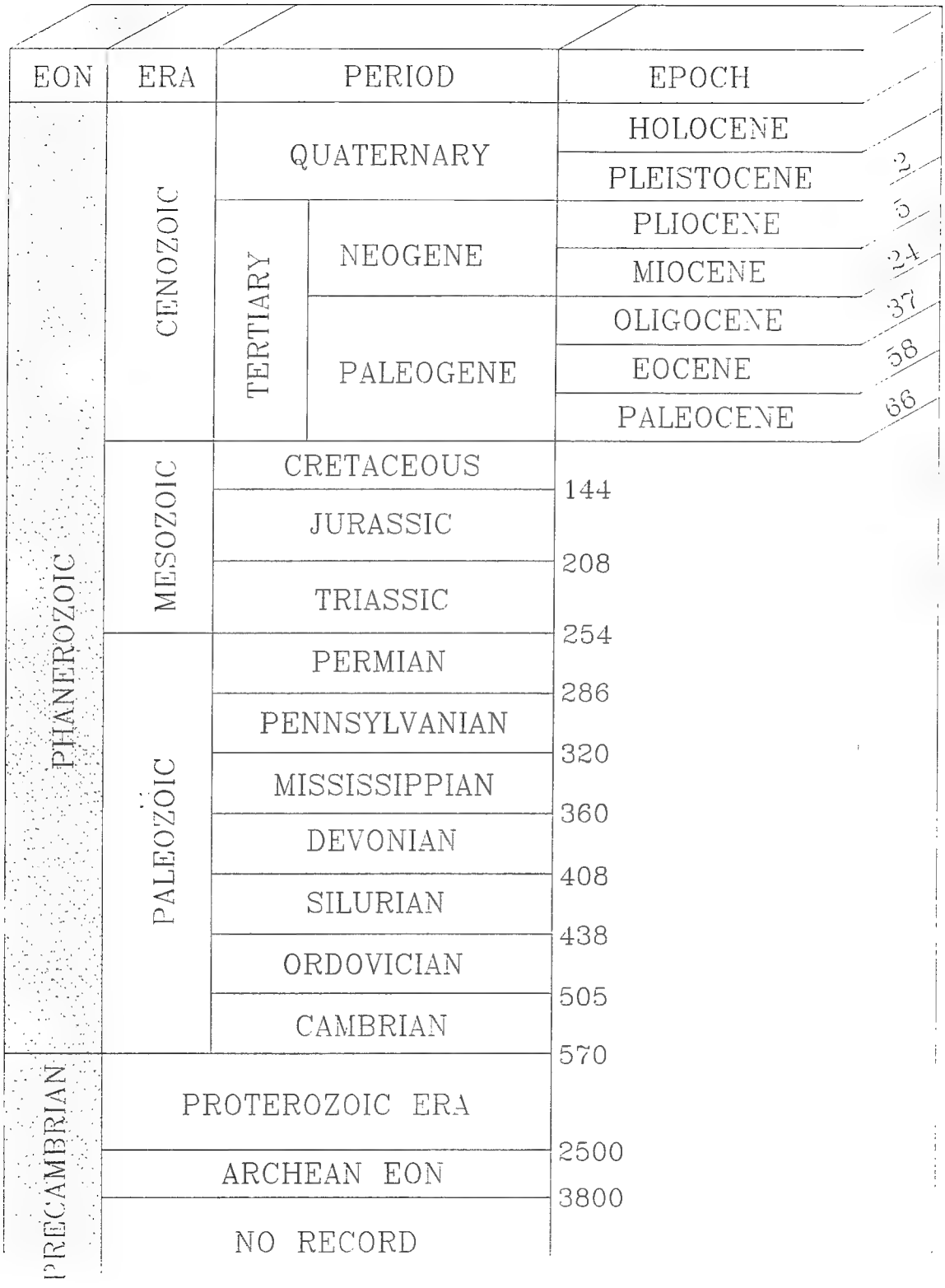
HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HYDRAULIC CONDUCTIVITY – The capacity of a rock to transmit water.

IGNEOUS ROCKS - Rock or mineral that has solidified from molten or partially molten material; i.e., from magma.

INJECTION WELL - A well into which subsurface disposal of fluid or fluids occurs or is intended to occur by means of injection.

LAGOON – A shallow stretch of seawater, such as a sound, channel, bay, or saltwater lake, near or communicating with the sea and partly or completely separated from it by a low, narrow, elongate strip of such such as a reef, barrier island, sandbank, or spit, especially the sheet of water between an offshore coral reef and the mainland.



NOTE. NUMBERS ARE IN MILLIONS OF YEARS BEFORE THE PRESENT

FIGURE GL.1

KEKAHA TIMESCAL

THE GEOLOGICAL TIME SCALE

291st Combat Communications Squadron
Hilo Air National Guard Station
Hilo, Hawaii

OPTECH
OPERATIONAL TECHNOLOGIES CORPORATION

JANUARY 1996

LAVA - Fluid rock that issues from a volcano or fissure; also, the same material solidified by cooling.

LITHOLOGY - (a) The description of rocks. (b) The physical character of a rock.

LOWLAND - A general term for low-lying land or an extensive region of low land, especially near the coast and including the extended plains or country lying not far above tide level.

MAGMA - Naturally occurring molten rock material, generated within the earth and capable of intrusion and extrusion, from which igneous rocks have been derived through solidification and related processes.

MANTLE – The zone of Earth below the crust and above the core.

MARSH - A water-saturated, poorly drained area, intermittently or permanently water-covered, having aquatic and grasslike vegetation, essentially without the formation of peat.

METAMORPHIC ROCK - Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes in response to changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the earth's crust.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

OLIVINE - A common rock-forming mineral of basic, ultrabasic, and low-silica igneous rocks (gabbro, basalt, peridotite, dunite); it crystallizes early from a magma, weathers readily at the earth's surface, and metamorphoses to serpentine.

OUTCROP - That part of a geological formation or structure that appears at the surface of the earth; also, bedrock that is covered only by surficial deposits such as alluvium.

PAHOEHOE - A Hawaiian term for basaltic lava flows typified by a smooth, billowy, or ropy surface.

PERCHED GROUNDWATER - Unconfined groundwater separated from the underlying main body of groundwater by unsaturated rock.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment by the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

GLOSSARY OF TERMS (Continued)

PHENOCRYSTS - One of the relatively large and ordinarily conspicuous crystals of the earliest generation in a porphyritic igneous rock.

PHREATIC EXPLOSION – A volcanic eruption or explosion of steam, mud, or other material that is not incandescent.

PHREATOMAGMATIC EXPLOSION – A volcanic explosion that extrudes both magmatic gases and steam; it is caused by the contact of magma with groundwater or shallow surface water.

POND - A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool.

POROSITY - The ratio of the aggregate volume of interstices in a rock or soil to its total volume.

PORPHYRITIC - A textural term for those igneous rocks in which larger crystals (phenocrysts or insets) are set in a finer groundmass which may be crystalline or glassy, or both.

POTENTIOMETRIC SURFACE - An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well. The water table is a particular potentiometric surface.

PYROCLAST – An individual particle ejected during a volcanic eruption.

RIFT ZONE - A system of crustal fractures and faults.

RIVER - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a defined channel toward a sea, lake, or another river.

ROCK – Any naturally formed, consolidated or unconsolidated material (but not soil) consisting of two or more minerals.

RUNOFF - The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff.

SALINE (adj) - Salty; containing dissolved sodium chloride.

SAND - A rock or mineral particle in the soil, having a diameter in the range 0.52 - 2mm.

SEDIMENT - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents. such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting from the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SEISMIC – Pertaining to an earthquake.

SILT (soil) - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002-0.005 mm; (b) A soil containing more than 80% silt-sized particles, less than 12% clay, and less than 20% sand.

SITE - Area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and may include areas between sources.

SOIL PERMEABILITY - The characteristics of the soil that enables water to move downward through the profile. Permeability is measured as the distance per unit time that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow -	less than 0.06 inches per hour (less than 4.24×10^{-5} cm/sec)
Slow -	0.06 to 0.20 inches per hour (4.24×10^{-5} to 1.41×10^{-4} cm/sec)
Moderately Slow -	0.20 to 0.63 inches per hour (1.41×10^{-4} to 4.45×10^{-4} cm/sec)
Moderate -	0.63 to 2.00 inches per hour (4.45×10^{-4} to 1.41×10^{-3} cm/sec)
Moderately Rapid -	2.00 to 6.00 inches per hour (1.41×10^{-3} to 4.24×10^{-3} cm/sec)
Rapid -	6.00 to 20.00 inches per hour (4.24×10^{-3} to 1.41×10^{-2} cm/sec)
Very Rapid -	more than 20.00 inches per hour (more than 1.41×10^{-2} cm/sec)

(Reference: U.S.D.A. Soil Conservation Service)

SOIL REACTION - The degree of acidity of alkalinity of a soil, expresses in pH values. A soil that tests of pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 to higher

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are - platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SOLVENTS - A substance, generally a liquid, capable of dissolving other substances.

SOURCE - Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, groundwater, surface water, or surface water sediments that have become contaminated by migration, except: in the case of either a groundwater plume with no identified source or contaminated surface water sediments with no identified source, the plume may be considered a source.

STONE - A general term for rock that is used for construction, either crushed for use as aggregate or cut into shaped blocks as dimension stone.

STRATIFIED - Formed, arranged, or laid down on layers or strata; especially said of any layered sedimentary rock or deposit.

STRATIGRAPHIC UNIT - A body of strata recognized as a unit for description, mapping, or correlation.

STRUCTURAL - Of or pertaining to rock deformation or to features that result from it.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

SWALE - A slight depression, sometimes swampy, in the midst of generally level land.

SWAMP - An area intermittently or permanently covered with water, having shrubs and trees but essentially without the accumulation of peat.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or significant portions of its range.

TIME (geologic) - See Figure Gl.1.

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

TSUNAMI - A great sea wave produced by a submarine earthquake or volcanic eruption (commonly and erroneously known as a "tidal wave").

TUFF – A general term for all consolidated pyroclastic rocks.

UNCONSOLIDATED - (a) Sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either on the surface or at depth. (b) Soil material that is in a loosely aggregated form.

UNDULATING (geomorph) - (a) A landform having a wavy outline or form. (b) A rippling or scalloped land surface, having a wavy outline or appearance.

VALLEY - Any low-lying land bordered by higher ground, especially an elongated, relatively large, gently sloping depression of the earth's surface, commonly situated between two mountains or between ranges of hills and mountains, and often containing a stream or river with an outlet. It is usually developed by stream or river erosion, but can be formed by faulting.

VEIN (intrusive rock) - A thin, sheetlike igneous intrusion into a fissure.

VESICLE - A small cavity in an aphanitic or glassy igneous rock, formed by the expansion of a bubble of gas or steam during the solidification of the rock.

VITRIC – Said of pyroclastic material that is characteristically glassy; i.e., contains more than 75% glass.

GLOSSARY OF TERMS (Concluded)

VOLCANO - A vent in the surface of the earth through which magma and associated gases and ash erupt; also, the form or structure, usually conical, that is produced by the ejected material.

WASTE DISPOSAL SYSTEM - An excavation in the ground receiving wastes which functions by allowing fluids to seep through its bottom, sides, or both, including cesspools, septic tanks, and seepage pits.

WATER TABLE - The upper limit of the portion of the ground that is wholly saturated with water; the surface on which the fluid pressure in the pores of a porous medium is exactly atmospheric.

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

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APPENDIX A

OUTSIDE AGENCIES CONTACTED

APPENDIX A

OUTSIDE AGENCIES CONTACTED

State of Hawaii
Department of Health
Environmental Management Division
Safe Drinking Water Branch
919 Ala Moana Boulevard
Honolulu, Hawaii 96813
(808) 586-4258

State of Hawaii
Department of Defense
Environmental Officer
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495
(808) 735-4659

State of Hawaii
Department of Defense
Office of the Adjutant General
Contracting & Engineering Officer
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495
(808) 735-3522

State of Hawaii
Department of Land and Natural Resources
Commission on Water Resource Management
Kalanimoku Building, Room 227
1151 Punchbowl Street
Honolulu, Hawaii 96809
(808) 587-0218

State of Hawaii
Office of Environmental Quality Control
Central Pacific Plaza
220 South King Street, 4th floor
Honolulu, Hawaii 96813
(808) 586-4185

OUTSIDE AGENCIES CONTACTED (Continued)

R. M. Towill Corporation
420 Waikamilo Road, Suite 411
Honolulu, Hawaii 96817-4941
(808) 842-1133

Hawaii Air National Guard
Environmental Management Office
154th Civil Engineering Squadron
360 Harbor Drive
Hickam Air Force Base, Hawaii 96853-5517
(808) 449-5711

Hawaii Air National Guard
291st Combat Communications Squadron
1300 Kekuanaoa Street
Hilo, Hawaii 96720-4568
(808) 961-6355

Hawaii Army National Guard
Fort Ruger, Hawaii
(808) 732-1574

Agency Information Consultants
1708 Guadalupe
Austin, Texas 78701
(512) 478-8991

State of Hawaii Archives
Iolani Palace Grounds
Honolulu, Hawaii
(808) 586-0329

U. S. Army Corps of Engineers
Pacific Ocean Division
Honolulu District
Fort Shafter, Hawaii 96858
(808) 438-1331

OUTSIDE AGENCIES CONTACTED (Concluded)

U.S. Department of Agriculture
Soil Conservation Service
Prince Kuhio Federal Building
Honolulu, Hawaii
(808) 541-2600

U.S. Fish and Wildlife
Pacific Islands Office
P. O. Box 50167
Honolulu, Hawaii 96850
(808) 541-2749

National Oceanic & Atmospheric Administration (NOAA)
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396
(808) 943-1221

U.S. Department of the Interior
U.S. Geological Survey
Branch of Distribution
Box 25286
Denver Federal Center, Bldg 810
Denver, CO 80225

County of Hawaii
Public Works Department
25 Aupuni Street
Hilo, Hawaii 96720
(808) 961-8321

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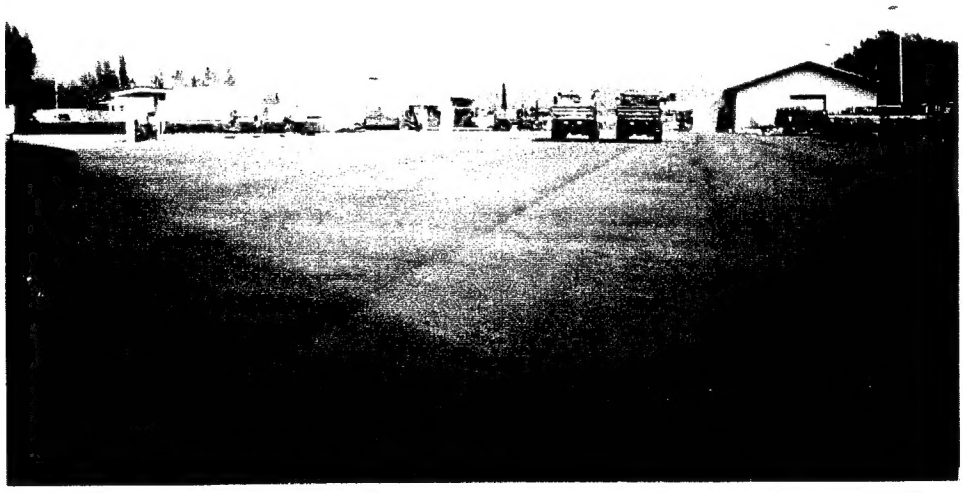
APPENDIX B

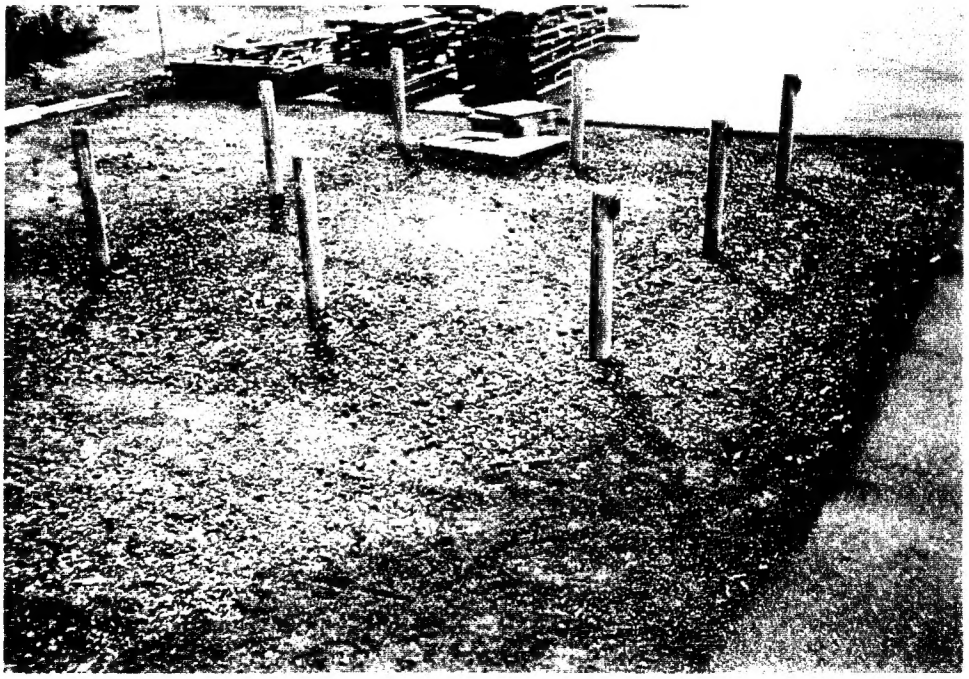
PHOTOGRAPHS

1. View of southeast portion of facility, showing drum storage and flammable materials storage shed.



2. View of truck parking area. Note fueling station at left center of photo.

3. Soil staining in natural swale paralleling the southeast fence line.



4. View of septic tank area, located in the north corner of the installation.